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NRL/VOA Modifications to IONCAP as of 12 July 1988

MARK DAEHLER

Ionospheric Effects Branch
Space Science Division

August 2, 1989

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This report documents modifications made by NRL to IONCAP 85.04, an HF ionospheric propagation prediction computer program developed by the National Telecommunications and Information Administration. These modifications serve to present the structure of multimode propagation more accurately, to separate the effects on system performance caused by antenna gain and ionospheric structure (thereby making it more suitable for wide-area coverage studies), to incorporate a newer noise model, to improve the accuracy of some calculations, to correct a few programming errors, and to make operation more convenient on the computers in use at NRL. The work was performed under the sponsorship of the Voice of America as a part of its facilities modernization program.

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NRL/VOA MODIFICATIONS TO IONCAP AS OF 12 JULY 1989

I. INTRODUCTION

The Ionospheric Effects Branch of the Naval Research Laboratory, at the request of the Voice of America/United States Information Agency, has performed several studies of HF ionospheric propagation which involve use of the IONCAP propagation prediction computer program. IONCAP, created by the National Telecommunications and Information Administration (NTIA), is the leading program for computing the performance of HF skywave propagation systems. The IONCAP 78.03 version has been documented in NTIA Report 83-127. The NRL/VOA work started with the IONCAP 85.04 version, which has been gradually modified to adapt to differences in computer hardware, to correct a few small coding errors, and to provide output which is more suitable for VOA requirements. Because of the large number of VOA and NRL personnel who are using the program and its results, and because the currently-calculated results are likely to be used for many years to come, it is considered imperative that an accurate record of program modifications be maintained. Because of the evolutionary nature of the modifications, continuous documentation is difficult, but it is possible to document the modified program from time to time. This document therefore describes the modifications made to IONCAP as of 12 July 1988. It is planned that further modifications will be described in future reports.

This report makes no attempt to fully document the Modified IONCAP program; it describes only the modifications which have been made to make it more suitable for NRL/VOA use. Modifications are described on two levels: a general, functional description, and a detailed line-by-line description of the FORTRAN changes. Thus Section II lists, in approximate order of importance, the modifications which have been made, the extent of the modifications, and the rationale for making them. Section III contains listings of the differences between the original and the modified programs, which will permit a user to recreate the NRL/VOA modified program from the original IONCAP 85.04.

An overview of which subprograms had been modified, and of the extent of the modifications, was obtained by running the VAX DIFFERENCES program on all of the IONCAP modules. The extent of the results is summmarized in Table 1, and the full DIFFERENCES data is reproduced in Section VI of this report. Table 1 lists all of the IONCAP modules, as well as the number of sections in each module in which differences were found between IONCAP 85.04 and the Modified IONCAP, and the total number of different records found in each module. The list includes the programs IONCAP_LTD (the long-term data base which accompanied IONCAP 85.04), and BCDBIN.FOR (which transforms the long-term data base back and forth between its ASCII and binary representations). To enable either of the old or new long-term data bases to be used, the new one was named NEW_IONCAP.LTD. In addition, Table 1 includes the file MAKDAT.FOR, a utility program used for creating a special pair of transmitter and reciever antenna patterns which satisfy particular VOA requirements. (See Section IIP.)

Manuscript approved June 8, 1989.

An important part of documentation is the retention of both original and modified versions in archival form. The current documentation consists of the following products:

1. The original IONCAP 85.04 program modules stored in the NRL Space Sciences Division VAX computer area USD1:[VOALIB.IONCAP.SOURCE];

2. A 9-track magnetic tape containing the above information, with the label "IONCAP 85.04 -- Original Version -- 27 November 1985";

3. A listing of the FORTRAN code contained in IONCAP 85.04, with the label "IONCAP 85.04 -- original version at NRL -- 27 November 1985";

4. The Modified IONCAP program stored in the NRL Space Sciences Division VAX computer area USD1:[VOALIB.NEWCAP.SOURCE];

5. A 9-track magnetic tape containing the above information, with the label "IONCAP 85.04 with NRL/VOA modifications as of 12 JULY 1988";

6. A listing of the FORTRAN code contained in the Modified IONCAP, with the label "FORTRAN Source Code for IONCAP 85.04 with NRL/VOA Modifications as of 12 July 1988".

7. This document.

TABLE 1: DIRECTORY OF IONCAP MODULES

MODULE	NAME	SIZE (128BYTE BLOCKS)	DIFFERENCES IN REVISED IONCAP # SECTIONS	# RECORDS
1	AERIAL.FOR;1	12	2	2
	ALLMODES.FOR	14	(Exists in Modified IONCAP only)	
2	ALOSFV.FOR;1	9	1	3
3	ANOIS1.FOR;1	4	1	6
4	BABS.FOR;1	3	2	4
5	BCDBIN.FOR;	13		
6	BEARNG.FOR;1	3	1	3
7	BENDY.FOR;1	1	1	3
8	BLKDAT.FOR;1	27	14	32
9	CALVHF.FOR;1	5	2	2
10	CISI.FOR;1	3	0	0
11	CNGTIM.FOR;1	4	0	0
12	CONVH.FOR;1	2	0	0
13	CURMUF.FOR;1	23	2	12
14	DECRED.FOR;1	56	7	25
15	DIREAD.FOR;1	1	1	2
16	EF1VAR.FOR;1	5	2	6
17	ESIND.FOR;1	3	1	3
18	ESMOD.FOR;1	14	6	31
19	ESREG.FOR;1	23	5	37
20	ESVHF.FOR;1	11	2	11
21	F2DIS.FOR;1	3	0	0
22	F2VAR.FOR;1	6	1	6
23	FDIST.FOR;1	7	2	9
24	FINDF.FOR;1	14	3	11
25	FIXLIN.FOR;1	2	1	1
26	FLOLIN.FOR;1	3	2	7
27	FNORML.FOR;1	2	0	0
28	FOBBY.FOR;1	3	1	7
29	FRQCOM.FOR;1	6	1	1
30	FVHF.FOR;1	6	3	9
31	GAIN.FOR;1	33	0	0
32	GENFAM.FOR;1	3	0	0
33	GENION.FOR;1	9	1	6
34	GENOIS.FOR;1	11	4	188
35	GEOM.FOR;1	14	2	8
36	GEOTIM.FOR;1	4	2	12
37	GETANT.FOR;1	6	0	0
38	GETHP.FOR;1	7	1	6
39	GETKMF.FOR;1	1	0	0
40	GETLUF.FOR;1	8	(Exists in IONCAP 85.04 only)	
41	GETTOP.FOR;1	4	1	5
42	GMLOSS.FOR;1	4	2	9
43	GPHBOD.FOR;1	15	1	1
44	HFMUFS.FOR;1	15	10	91
45	INMOD.FOR;1	10	8	30
46	INMUF.FOR;1	11	1	4
47	IONCAP.FOR;1	6	4	207
48	IONCAP_LTD.ASCII (85.04); NEW_LTD.ASCII (Modified IONCAP)	2721	5	2800
49	IONPLT.FOR;1	11	5	17
50	IONSET.FOR;1	4	1	3
51	LECDEN.FOR;1	13	2	8

TABLE 1: DIRECTORY OF IONCAP MODULES (Cont.)

MODULE	NAME	SIZE (128BYTE BLOCKS)	DIFFERENCES IN REVISED IONCAP # SECTIONS	# RECORDS
52	LISTIN.FOR;1	10	2	4
53	LNGLUF.FOR;1	9	(Exists in IONCAP 85.04 only)	
54	LNGOUT.FOR;1	5	4	20
55	LNGPAT.FOR;1	11	3	18
56	LUFFY.FOR;1	16	8	290
57	MAGFIN.FOR;1	8	0	0
58	MAGVAR.FOR;1	3	1	3
59	MAKDAT.FOR;1	5		
60	MONITR.FOR;1	4	0	0
61	MPATH.FOR;1	3	3	10
62	NOISY.FOR;1	5	0	0
63	NOMMUF.FOR;1	7	1	7
64	OUTALL.FOR;1	17	9	168
65	OUTANT.FOR;1	10	5	7
66	OUTBOD.FOR;1	13	7	38
67	OUTCOM.FOR;1	2	0	0
68	OUTGPH.FOR;1	2	0	0
69	OUTION.FOR;1	1	1	3
70	OUTKMF.FOR;1	1	0	0
71	OUTLAY.FOR;1	3	1	1
72	OUTLIN.FOR;1	2	0	0
73	OUTLNG.FOR;1	4	3	5
74	OUTMUF.FOR;1	6	1	1
75	OUTPAR.FOR;1	6	4	21
76	OUTTAB.FOR;1	2	1	1
77	OUTTOP.FOR;1	12	4	9
78	PEN.FOR;1	1	1	3
79	PENANG.FOR;1	6	2	5
80	PREMUF.FOR;1	4	1	1
81	REDMAP.FOR;1	14	4	5
82	REGMOD.FOR;1	20	7	61
83	RELBIL.FOR;1	15	10	125
84	SANG.FOR;1	3	1	4
85	SELMOD.FOR;1	3	1	3
86	SELRCR.FOR;1	5	1	12
87	SELTMT.FOR;1	5	3	8
88	SERPRB.FOR;1	7	4	23
89	SETGPH.FOR;1	5	0	0
90	SETLNG.FOR;1	6	5	13
91	SETLUF.FOR;1	3	2	3
92	SETOUT.FOR;1	9	2	2
93	SETRCR.FOR;1	11	2	22
94	SETTMT.FOR;1	12	2	22
95	SHTLUF.FOR;1	13	(Exists in IONCAP 85.04 only)	
96	SIGDIS.FOR;1	11	2	14
97	SYSSY.FOR;1	4	0	0
98	TABBOD.FOR;1	7	1	1
99	TABS.FOR;1	2	1	5
100	TIMVAR.FOR;1	5	1	5
101	VERSY.FOR;1	6	2	4
102	VIRTIM.FOR;1	5	2	6
103	XLIN.FOR;1	2	0	0

II. DESCRIPTIONS OF MAJOR MODIFICATIONS

A. Changes in System Performance Calculations and in Method 25 (All Modes) Output

Several changes have been made to the System Performance calculations, Methods 16-25, and especially to the Method 25 (All Modes) output calculations and format, to make the data more accurate and readable. The basic change is to present the performance data separately for each propagating mode, in addition to the summary which reports the collective effect of all contributing modes. This contrasts with the procedure in IONCAP 85.04, in which separate summaries are given for the collections of all n-hop modes, all the (n+1)-hop modes, and all (n+2)-hop modes (where n is the lowest hop number of all contributing modes), with an additional summary for the collective effect of all contributing modes. The change corrects a condition in IONCAP 85.04 in which summary data for lower-hop modes sometimes appears in columns where higher-hop data should appear, and in which signal strength calculations appearing in the System Performance outputs of Methods 16-26 could be in error by as much as 3 dB.

In IONCAP 85.04, the system performance of an HF path is calculated in a series of steps. Calculations are made for the smallest number of hops (n) for which propagation is possible, and also for the next two larger number of hops (n+1 and n+2). In the first step, the performances of all n-hop modes (E, F1, and F2, both LO and HI ray) are calculated, and the most reliable of these, termed the n-hop Most Reliable Mode (n-hop MRM) is identified. In the output data, the propagation characteristics of this mode are tabulated in the first column, along with the signal strength, noise, and reliability measures for the circuit derived from an rms summation of contributions from all of the n-hop propagating modes. In succeeding steps, the (n+1)-hop MRM and (n+2)-hop MRM are identified, and the corresponding propagation and performance data are printed in the second and third columns. The performances of one- and two-hop sporadic E modes are also calculated, if they exist, and those data are printed in columns 4 and 5. Then, in a comparison of these five selected modes, the one with the greatest reliability is identified and designated the System MRM. The system performance quantities for the System MRM are derived from an rms summation of the contributions from all five listed modes. The Method 25 output tabulates the performance properties of the five selected modes, and also of the System MRM.

However, a problem arises in the IONCAP 85.04 system performance calculations when no (n+1)-hop and/or no (n+2)-hop modes exist. In this situation the program (incorrectly) may retain the data for some lower-hop mode and use it as the (n+1)-hop or (n+2)-hop MRM data. The consequence, in Method 20, is the presence of spurious listings in the output data for the (n+1)hop- and/or (n+2)-hop modes, and in all of the System Performance Methods 16-26, an error of up to 3 dB in the signal strength of the System MRM.

This problem has been corrected in the Modified IONCAP by saving the data for <u>all</u> of the propagating modes, and only then calculating the Most Reliable Mode. In addition, the Method 25 output has been modified to list the performance results for each of the modes separately, and also for the Most Reliable Mode, with the system performance. There can be up to 20 of these modes.

The modified output format can be illustrated by a comparison of output data obtained with the input data file shown in Figure 1. Figure 2a shows the IONCAP 85.04 data for one frequency-time combination, and Figure 2b shows the corresponding data from the Modified IONCAP program. Where IONCAP 85.04 lists three modes, which are the most reliable 5-hop, most reliable 6-hop, and most reliable 7-hop modes, the Modified IONCAP lists nine modes: the three propagating modes for each of 5, 6, and 7 hops. (There could be up to eighteen of these modes, plus two sporadic E modes.) In the first column of IONCAP mode data, the heading 5.F2 means that the 5.F2 mode is the most reliable of all 5-hop modes, and the eight propagation characteristics which follow (time delay, angle, virtual height, transmission loss, transmitter and receiver gains, absorption, and FS loss) refer to that mode. The rest of the quantitites in the column, however, refer to the sum of all (three) 5-hop modes. In the corresponding columns of Modified IONCAP data, all quantities refer to the single mode listed as the heading. In both IONCAP 85.04 and Modified IONCAP, the last data column is headed with the name of the most reliable mode (regardless of number of hops), and the first six propagation quantities refer to that mode, but the remaining ones refer to the combination of all contributing modes.

An example demonstrating the elimination of spurious data is shown in Figures 3 (input data) and 4a,b. In this example, there are three regular (non-sporadic E) 1-hop modes, and no regular 2- or 3-hop modes. In the IONCAP 85.04 output, the first mode-data column is properly headed with the name of the most reliable mode, 1.F1, and contains propagation data for that mode and reliability data for the sum of all 1-hop modes. The second and third data columns should be blank, since 2- and 3-hop modes don't exist in this case. However, they actually contain residual data left over from the 1-hop calculations. The problem doesn't arise in the Modified IONCAP data because the number of columns is adjusted to equal the number of propagating modes.

The process of storing data for all propagating modes is implemented by calls from subroutines INMOD and LUFFY to a new subroutine named SUBROUTINE ALLMODES(IFLG,FVAL). In this subroutine, performance data for all the propagating modes are stored in a set of arrays (in the new common block /ALLMODE/) from which the new Method 25 data are selected and printed out. The parameters used to call the ALLMODES(IFLG,FVAL) subroutine have the following significance:

1. ALLMODES is called from LUFFY with four calls:
   1st call (initialization):
   IFLG=0
   FVAL=current frequency being processed in the LUFFY frequency loop

   2nd call (for short-paths, for each value of hop in hop loop):
   IFLG=100 or 300, for system performance or LUF calculations, respectively
   FVAL=number of hops

```
IONOSPHERIC COMMUNICATIONS ANALYSIS AND PREDICTION PROGRAM - IONCAP   VERSION 88.01

         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890

MONTH       1987     9
SUNSPOT      97.
LABEL      FORT COLLINS TO HIRAISO, IBARAKI, JAPAN
CIRCUIT    40.68N     105.0W     36.37N     140.6E          0
SYSTEM      7.10 145.    .10  90.   73.    3.     .1
TIME           1     1     1     1
METHOD        25
ANTENNA        1     2        .01  10.       -0.5   0.
ANTENNA        2     2        .01  10.        4.50  0.
FREQUENCY   6.08
EXECUTE
QUIT
```

Figure 1. Data file used to show differences between IONCAP 85.04 output data and Modified IONCAP output data.

```
                              METHOD 25   IONCAP 85.04   PAGE   1

          SEP    1987          SSN =  97
 FORT COLLINS TO HIRAISO, IBARAKI, JAPAN   AZIMUTHS          N. MI.       KM
 40.68 N  105.00 W - 36.37 N  140.60 E    312.27   44.18    4939.9    9148.0
                              MINIMUM ANGLE   0.1  DEGREES
 ITS- 1 ANTENNA PACKAGE
 XMTR   2.0  TO  30.0  VER MONOPOLE H    0.00 L   -0.50 A    0.0  OFF AZ    0.0
 RCVR   2.0  TO  30.0  VER MONOPOLE H    0.00 L    4.50 A    0.0  OFF AZ    0.0
 POWER =   7.100 KW  3 MHZ NOISE = -145.0 DBW   REQ. REL =  .90  REQ. SNR = 73.0

                              YE =  20.0     HE =  110.0     HS =  110.0

 LAT    LONG     LMT    UT     E      F1     Y1      H1    FH/2   F2Z     Y2      H2    ES  MED   HI  M3000   HPF2   RAT   ZEN   ZMAX   MAGL
46.3N 114.6W   17.4   1.0   1.98    0.0    0.0     0.0    0.7   7.7    94.9   322.9   1.0  1.7   2.9   3.02   318.0   3.5   85.4  61.8   53.6N
51.0N 126.3W   16.6   1.0   3.22    0.0    0.0     0.0    0.7   7.6   109.7   335.7   1.5  1.8   2.9   2.98   324.8   3.4   79.1  63.3   56.1N
55.7N 164.9W   14.0   1.0   3.85    5.1   48.9   195.6    0.6   8.7   127.1   314.0   2.0  2.2   2.9   2.89   339.8   3.1   63.6  63.3   53.0N
47.9N 159.3E   11.6   1.0   3.79    5.0   49.5   197.8    0.6   8.7   127.1   314.0   2.3  2.8   4.0   2.95   329.5   2.5   51.0  57.9   39.7N
42.5N 149.1E   10.9   1.0   3.85    5.1   48.9   195.6    0.6   9.2   127.2   309.1   2.3  2.9   4.4   2.99   321.9   2.4   47.6  54.8   33.1N

                              FREQ =   6.1 MHZ  UT =   1.0

                      5 F2        6 F2        7 F2        5 F2
 TIME DEL          33.353      33.615      34.106      33.353
 ANGLE             16.021      18.239      20.855      16.021
 VIR  HITE        345.090     310.620     295.042     345.090
 TRAN LOSS        301.053     308.371     314.502     301.053
 T  GAIN            0.292       0.272       0.079       0.292
 R  GAIN          -11.672     -11.381     -11.155     -11.672
 ABSORB            25.454      23.216      21.001
 FS  LOSS         128.128     128.196     128.322
 FIELD ST        -127.990    -135.599    -141.957    -127.150
 SIG  POW        -262.000    -269.000    -275.000    -261.000
 SNR             -102.638    -109.956    -116.088    -101.670
 MODE PROB          1.000       1.000       1.000       1.000
R. PWRG          1000.000    1000.000    1000.000     187.604
RELIABIL            0.000       0.000       0.000       0.000
 SERV PROB          0.000       0.000       0.000       0.000
 SIG LOW           10.625      11.811      13.149      10.874
  SIG  UP           9.423       8.929       8.428       9.311
 NOISE =   -159        S. POWER =   -261
 SIGNAL =   14.2     9.9     6.8  /    2.8     5.0     1.7
 NOISE =     9.0  -159.9     7.0  /    1.5     3.0     1.5
 RELIAB =   13.0  -101.7    12.9
 SPROB =     0.0     0.0     0.0
```

Figure 2a. Sample of IONCAP 85.04 output data obtained with the input file of Figure 1. The first data column labelled 5.F2 refers to the most reliable of the lowest-order (in this case, 5-hop) regular (non sporadic E) modes, and to the signal strength and reliability properties of the sum of all propagating 5-hop modes. Similar data are given for 6- and 7-hop modes. The last column, also labelled 5.F2, refers to the most reliable of all propagating modes and to the signal strength and reliability properties of the sum of all propagating modes.

```
                                METHOD 25    IONCAP 88.01    PAGE   1

          SEP     1987           SSN =  97
 FORT COLLINS TO HIRAISO, IBARAKI, JAPAN   AZIMUTHS          N MI        KM
 40 68 N  105 00 W - 36 37 N  140 60 E     312.27    44 18    4939.7    9148.0
                                MINIMUM ANGLE   0.1  DEGREES
 ITS- 1 ANTENNA PACKAGE
 XMTR   2.0  TO   30.0  VER MONOPOLE H     0.00 L    -0.50 A     0.0  OFF AZ     0.0
 RCVR   2.0  TO   30.0  VER MONOPOLE H     0.00 L     4.50 A     0.0  OFF AZ     0.0
 POWER =    7.100 KW  3 MHZ NOISE = -145.0 DBW   REQ. REL =  90  REQ. SNR = 73.0

                                YE =  20.0     HE = 110.0     HS = 110.0

  LAT    LONG     LMT     UT     E      F1     Y1      H1    FH/2   F2Z     Y2      H2     ES   MED   HI  M3000   HPF2   RAT    ZEN   ZMAX   MAGL
 46.3N 114.6W   17.4    1.0   1.98    0.0    0.0     0.0    0.7    7.7   94.9   322.9    1.0   1.7   2.9   3.02   318.0   3.5   85.4   61.8   53.6N
 51.0N 126.3W   16.6    1.0   3.22    0.0    0.0     0.0    0.7    7.6  109.7   335.7    1.5   1.8   2.9   2.98   324.8   3.4   79.1   63.3   56.1N
 55.7N 164.9W   14.0    1.0   3.85    5.1   48.9   195.6    0.6    8.7  127.1   314.0    2.0   2.2   2.9   2.89   339.8   3.1   63.6   63.3   53.0N
 47.9N 159.3E   11.6    1.0   3.79    5.0   49.5   197.8    0.6    8.7  127.1   314.0    2.3   2.8   4.0   2.95   329.5   2.5   51.0   57.9   39.7N
 42.5N 149.1E   10.9    1.0   3.85    5.1   48.9   195.6    0.6    9.2  127.2   308.1    2.3   2.9   4.4   2.99   321.9   2.4   47.6   54.8   33.1N

SUMMARY     9 MODES    FREQ =    6.1 MHZ  UT =    1.0

                                                                                                                          Most REL
                    5. E        5. E        5. F2       6. E        6. E        6. F2       7. E        7. E        7. F2       5. F2
 TIME DEL        30.90       33.36       33.35       30.99       33.12       33.61       31.09       32.92       34.11       33.35
 ANGLE            1.99       16.06       16.02        3.93       16.35       18.24        5.70       16.40       20.85       16.02
 VIR. HITE       98.80      345.85      345.09       99.34      280.44      310.62      100.09      233.71      295.04      345.09
 TRAN. LOSS     391.37      494.92      300.15      413.85      522.44      307.47      435.08      544.10      313.60      300.15
 T. GAIN         -9.90        0.29        0.29       -5.24        0.30        0.27       -3.09        0.30        0.08        0.29
R. GAIN         -22.90      -11.67      -11.67      -18.19      -11.62      -11.38      -15.97      -11.62      -11.15      -11.67
 ABSORB          47.70       25.41       25.45       45.10       25.10       23.22       41.95       25.05       21.00
 FS. LOSS       127.46      128.13      128.13      127.49      128.07      128.20      127.52      128.01      128.32
 FIELD ST.     -207.08     -321.86     -127.09     -234.27     -349.42     -134.70     -257.72     -371.09     -141.06     -126.25
 SIG. POW.     -352.85     -456.41     -261.64     -375.34     -483.92     -268.96     -396.57     -505.59     -275.09     -260.74
 SNR           -193.09     -296.64     -101.87     -215.57     -324.15     -109.19     -236.80     -345.82     -115.32     -100.97
 MODE PROB        1.00        1.00        1.00        1.00        1.00        1.00        1.00        1.00        1.00        1.00
R. PWRG       1000.00     1000.00     1000.00     1000.00     1000.00     1000.00     1000.00     1000.00     1000.00      181.74
RELIABIL         0.00        0.00        0.00        0.00        0.00        0.00        0.00        0.00        0.00        0.00
 SERV PROB       0.00        0.00        0.00        0.00        0.00        0.00        0.00        0.00        0.00        0.00
 SIG LOW         8.42       25.00        4.74        8.63       25.00        5.92        9.48       25.00        7.26        4.97
  SIG UP         5.21       25.00        7.80        5.22       25.00        7.31        5.24       25.00        6.81        7.70
 NOISE =   -159        S  POWER = -260.7
 SIGNAL =                                  /     8.3         9.0         5.2
   2.8      5.0      1.7
 NOISE =      9.7  -159.8        6.0   /       1.5         5.3         1.5
 RELIAB =    12.4  -101.0        7.8
 SPROB =      0.0     0.0        0.0
```

Figure 2b. Sample of Modofied IONCAP output data obtained using the input file of Figure 1. Each of the data columns except for the last refers to a single mode of propagation. All propagating modes are represented; these can be up to 20 of them. The last column lists the most reliable of all the modes, re-states some of the characteristics of that mode, and lists signal strength and reliability properties for the sum of all propagating modes.

```
IONOSPHERIC COMMUNICATIONS ANALYSIS AND PREDICTION PROGRAM - IONCAP   VERSION 88.01

         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890

MONTH       1987    2
SUNSPOT        2.
LABEL       TEST CIRCUIT
CIRCUIT    32.60N    83.60W    42.50N    71.60W         0
SYSTEM         1.  145.  .001  90.   45.   30.   3.0
TIME          16   16     1    1
METHOD        25
ANTENNA        1   12          .01   10.
ANTENNA        2    2          .03    2.          2.
FREQUENCY  11.4 15.0
EXECUTE
QUIT
```

Figure 3. Data file used to demonstrate elimination of spurious Method 25 data in the Modified IONCAP output data.

```
                              METHOD 25   IONCAP 85.04   PAGE   1

          FEB     1987           SSN =   2
 TEST CIRCUIT                                AZIMUTHS          N. MI.       KM
 32 60 N   83 60 W - 42 50 N    71 60 W      40.32  227 68      822.7    1523 5
                              MINIMUM ANGLE   0.0  DEGREES
 ITS- 1 ANTENNA PACKAGE
 XMTR   2.0  TO   30.0  CONST. GAIN  H     0.00 L     0.00 A     0.0  OFF AZ     0.0
 RCVR   2 0  TO   30 0  VER MONOPOLE H     0.00 L     2.00 A     0.0  OFF AZ     0 0
 POWER =   1.000 KW  3 MHZ NOISE = -145.0 DBW   REQ. REL = .90  REQ. SNR = 45 0

                              YE =  20.0     HE = 110.0     HS = 110 0

 LAT   LONG    LMT    UT     E     F1     Y1     H1  FH/2   F2Z    Y2     H2   ES  MED   HI M3000   HPF2   RAT    ZEN  ZMAX  MAGL
37.7N  78.0W  10.8  16.0  3.12   3.9   19.5  168.7   0 7   6.0  80.1  229.3  1.4  2.0  2.7  3.47  253.7   2.9   57 5  69 1  49 0N


                    FREQ =  11.4 MHZ  UT =  16.0

                1 F1       1  E       1 F1       1 ES       2 ES       1 F1
 TIME DEL.       5 400      5.358      5.400      5.175      5.331      5 400
 ANGLE          13 294     12 034     13 294      4.712     14 261     13 294
 VIR. HITE     233.293    214.475    233.293    110.000    110 000    233 293
 TRAN. LOSS    153 402    178.744    153.402    175.418   1317.068    153.402
 T. GAIN         0 000      0.000      0.000      0.000      0.000      0.000
R. GAIN        -14 472    -14.754    -14.472    -18.866    -14 294    -14.472
 ABSORB         10.046     10.657     10.046     13.580      9.612
 FS. LOSS      117 774    117.706    117 774    117.403    117 661
 FIELD ST.      23.298     -5.652     19.408      1.787  -1144.436     24 811
 SIG. POW.    -121 000   -148.744   -123.402   -145.418  -1287.068   -119.000
 SNR            46 856     19.903     45.245     23.230  -1118 420     48 844
 MODE PROB       0 686      0.986      0 686      0.304      0 093      0:686
R. PWRG       1000.000   1000.000   1000.000   1000.000   1000.000     8.860
RELIABIL         0 583      0.113      0.506      0 046      0 000      0.651
 SERV PROB       0.000      0 001      0 001      0.001      0 001      0.000
 SIG LOW         8.955     25 000     18.278     25 000     25.000     10.660
  SIG  UP        7.967     25 000      8.433     14.062     25.000      8.385
 NOISE =   -168        S. POWER =   -119
 SIGNAL =     3.0     6.4     4 2  /     2.3     3.3     0.7
 NOISE =      8.8  -168.6     6 9  /     1.1     2.7     1.1
 RELIAB =    12 2    48.8    12 7
 SPROB =      0 0     0.0     0 0
```

Figure 4a. Sample of IONCAP 85.04 output data obtained with the input file of Figure 3. In this situation the only regular (non sporadic E) propagating modes are 1E (LO ray), 1E (HI ray), and 1F1. The first column of mode data contains data on the most reliable 1-hop mode. The second and third columns would normally contain data on 2-hop and 3-hop modes, respectively. In this case, however, those modes don't exist, and in their places spurious data from the 1-hop calculations appears.

```
                                METHOD 25   IONCAP 88.01   PAGE   1

          FEB     1987                SSN =   2.
 TEST CIRCUIT                                    AZIMUTHS          N MI.        KM
 32 60 N   83 60 W - 42 50 N    71 60 W          40 32  227 68     822.7     1523.5
                                MINIMUM ANGLE   0.0  DEGREES
 ITS- 1 ANTENNA PACKAGE
 XMTR   2 0  TO  30.0  CONST. GAIN  H    0 00 L     0.00 A     0 0  OFF AZ     0 0
 RCVR   2 0  TO  30.0  VER MONOPOLE H    0.00 L     2.00 A     0.0  OFF AZ     0 0
 POWER =   1.000 KW  3 MHZ NOISE = -145.0 DBW   REQ. REL =  90  REQ. SNR = 45.0

                                YE =  20.0     HE = 110.0     HS = 110.0

 LAT   LONG    LMT    UT     E     F1     Y1     H1   FH/2   F2Z    Y2     H2    ES  MED   HI M3000   HPF2   RAT    ZEN   ZMAX   MAGL
37.7N  78.0W  10.8   16.0  3.12   3.9   19.5  168.7   0 7    6 0  80.1  229.3  1.4  2.0  2.7  3.47  253.7   2.9   57.5   69.1   49 ON


SUMMARY     5 MODES   FREQ =  11.4 MHZ  UT =  16.0
                                                                          Most REL
                    1  E       1. E       1 F1       1.ES       2 ES      1.F1
 TIME DEL.          5.16       5.36       5.40       5.17       5.33      5.40
 ANGLE              4.17      12.03      13.29       4.71      14.26     13.29
 VIR  HITE        102.46     214.47     233.29     110.00     110.00    233.29
 TRAN.LOSS        156.91     178 74     153.40     175.42    1317.07    153.40
 T.  GAIN           0.00       0.00       0.00       0.00       0.00      0 00
R.  GAIN          -19.58     -14.75     -14.47     -18.87     -14.29    -14.47
 ABSORB            15.50      10.66      10.05      13.58       9.61
 FS.  LOSS        117.39     117.71     117.77     117.40     117.66
 FIELD ST.         21.01      -5.65      19.41       1.79   -1144.44     23.33
 SIG.  POW.      -126.91    -148.74    -123.40    -145.42   -1287.07   -121.77
 SNR               41.41      19.57      44.92      22.90   -1118.75     46.55
 MODE PROP          0.99       0.99       0.69       0.30       0.09      0.69
R.  PWRG        1000.00    1000.00    1000.00    1000.00    1000.00      8.96
RELIABIL           0.33       0.11       0.50       0.05       0.00      0.57
 SERV PROB         0.00       0.00       0.00       0.00       0.00      0.00
 SIG LOW           4.20      25.00      18.28      25.00      25.00      8 97
  SIG  UP          4.22      25.00       8.43      14.0ɔ      25.00      8.02
 NOISE =   -168        S. POWER = -121.8
 SIGNAL =                                /    3 0     6.4      4.2
   2 3     3.3      0 7
 NOISE =     9.4  -168.3      5 5   /      1.4      4.6      2.0
 RELIAB =   12.4    46.5     10.5
 SPROB =     0 0     0.0      0.0
```

Figure 4b. Sample of Modified IONCAP output data obtained with the input file of Figure 3. The three regular (non sporadic E) modes, 1E (LO ray), 1E (HI ray), and 1F1, are described in the first three columns of mode data, followed by two columns of sporadic E mode data and the most-reliable-mode summary data.

3rd call (for short-paths, after sporadic E mode performances have been determined):

IFLG=2
FVAL=999

4th call (for long paths):

IFLG=1
FVAL=999

2. When no mode exists which is below the MUF, subroutine INMOD is invoked to select an over-the-MUF mode, the data for which is stored by another call to ALLMODES(IFLG,FVAL), with the parameters indicating

IFLG=101 or 301 if the frequency is above the MUF, or
IFLG=102 or 302 if the frequency is below the MUF;
FVAL= number of hops

A listing of the new subroutine ALLMODES.FOR is attached as section III.

B. Addition of an Antenna-independent "All Modes" Ouput (METHOD 125) for Use with IONANT

In addition to changing the contents and format of the Method 25 All Modes data output, a new provision has been added in the Modified IONCAP to provide information which is similar to the Method 25 data, but excludes the effect of antenna gains. This method, termed Method 125, is useful in studying area coverage as a function of antenna properties, because the ionospheric data need be calculated only once. The data are in fact designed specifically for use with the the VOA/NRL IONANT program. Data for each test point are stored in a separate file with the name of the test point.

Some confusion may arise because the outputs from both Method 25 and Method 125 are termed "All Modes" outputs. In addition, the Method 125 All Modes data are generated in a subroutine named ALLMODES, and the variables containing that data are contained in the COMMON block named /ALLMODE/.

Method 125 is selected by including "125" in columns 21-25 of the METHOD input card. When METHOD 125 is selected, any entry in the usual METHOD entry location, columns 11-15, is ignored.

Method 125 creates a separate output file for each path, and the file is given the name of that path (e.g., tangr12345). Data are written in unformatted form. Each Method 125 output file contains the following data, each item identified below by its FORTRAN name and meaning:

Path Data:

```
                    (  TLATD   = absolute val. of xmtr latitude [deg]
                    (  ITLAT   = N or S, for North or South xmtr latitude
                    (  TLONGD  = absolute val. of xmtr longitude [deg]
                    (  ITLONG  = E or W, for East or West xmtr longitude
                    (  RLATD   = absolute val. of rcvr latitude [deg]
                    (  IRLAT   = N or S, for North or South rcvr latitude
                    (  RLONGD  = absolute val. of rcvr longitude [deg]
                    (  IRLONG  = E or W, for East or West rcvr longitude
                    (  BTRD    = bearing [deg] from xmtr to rcvr
                    (  GCDKM   = great circle path longth [km]
                    (  RSN     = required signal/noise ratio [dB]
                    (  LUFP    = LUF probability
                    (  NYEAR   = calendar year minus 1900
```

Mode Data:

```
  Written at beginning and
  at each SSN change in SSN
  within SSN loop:              SSN      = Sunspot number

  Written at beginning and
  at each change in Year
  within Year loop:             NYEAR    = calendar year minus 1900

  Written at beginning and
  at each hour change
  inside Hour loop:             GMT      = time (GMT)

                          (     NMMOD    = number of propagating modes
                          (     FREQ     = frequency
                          (     For i = 1 to NMMOD:
  Written for all         (        ZTLOSS(i)  = propagation loss [dB] of mode i
  combinations of SSN,    (        XB(i)      = take-off angle for mode i
  Month, Hour, and Freq-  (        ZTLLOW(i)  = lower decile transmission loss
                                                [dB] for mode i
  uency values specified  (        ZTLHGH(i)  = upper decile transmission loss
                                                [dB] for mode i
  in IONCAP input deck:   (     RCNSE    = Receiver noise [dB]
                          (     DU       = upper decile of receiver noise [dB]
                          (     DL       = lower decile of receiver noise [dB]
```

Method 125 is implemented by statements from subroutines ESMOD, ESREG, GENOIS, HFMUFS, AND LUFFY. These statements open the output file, write output data, omit the regular output data, and direct antenna gain subroutines not to be called. The logical unit for Method 125 output is designated m100 in the Modified IONCAP. In place of the usual output data written to logical unit LUO, data on the number of modes for each sunspot number, month, hour, and frequency are written into LUO, the usual output data logical unit. This feature, incoporated into subroutine HFMUFS, could be omitted without degrading the usefulness of the program.

C. Incorporation of an Updated Noise Model into IONCAP

A new noise model for HF systems has been developed by A. D. Spaulding and F. G. Stewart of the Institute for Telecommunication Sciences, National Telecommmunications and Information Administration, U. S. Department of Commerce, Boulder, Co 80303-3328. This model, which evolved over a period of more than two decades, is described in NTIA Report 87-212 (January 1987). The abstract is quoted here:

> "This report presents an updated and improved noise model designed for use in the HF propagation prediction program, IONCAP. The model has, however, much more general applicability, since the frequency range 10 kHz to 30 MHz is covered. The report gives the history, as near as can be determined, of the existing noise routines, and then develops the updated model based on current information. The three noise sources - atmospheric, man-made, and galactic are treated and a more appropriate means of combining these three sources is developed. Examples of the use of the improved model in IONCAP are included and comparisons made with the existing model.

The changes essential to applying the improved noise model appear in a new version of subroutine GENOIS. This version, with only such changes as required to accomplish modifications discussed elsewhere in this report, was incorporated in the Modified IONCAP. The NTIA report also included versions of subroutines ANOIS1, NOISY, and GENFAM, which were not substituted into the Modified IONCAP. Copies of the FORTRAN versions of GENOIS, ANOIS1, NOISY, and GENFAM contained in the NTIA report are included as Section IV of this report.

The new model comprises the following three major changes:

1. A change to the new atmospheric noise model described in CCIR Report 322-3 (1986), the details of which are contained in the report Atmospheric Radio Noise: Worldwide Levels and Other Characteristics, (NTIA/ITS Report 85-173, NTIS Order No. PB85-212942), by A. D. Spaulding and J. S. Washburn (1985).

2. A change to the updated man-made noise model published as CCIR Report 258-4 (1982), incorporating the data from the report Man-made Radio Noise, Part 1: Estimates for Business, Residential, and Rural Areas, (Office of Telecommunications Report 74-83, NTIS Order No. COM75-10798/AS), by A. D. Spaulding and R. T. Disney (1974).

3. Inclusion of a new way of summing noise contributions. IONCAP 85.04 considers noise of three types: atmospheric, galactic, and man-made, and each is represented by a log-normal distribution of amplitudes. In the old version of subroutine GENOIS the median value of the total is calculated from a simple sum of the median values. In the updated GENOIS the calculation is made in a more complicated, but more accurate, way. In this procedure, the summed noise distribution, which is not log-normal, is represented by the log-normal

Table II. Difference between the new and old values of man-made and galactic noise. (From NTIA Report 87-212 by A. D. Spaulding and F. G. Stewart).

Noise Difference (Old - New) [dB]

Frequency	Area Type				
	Business	Residential	Rural	Quiet Rural	Galactic
2 MHz	-15.5	-8.8	-2.1	+0.1	2.2
4	-15.4	-8.7	-2.0	-0.1	1.9
6	-15.3	-8.6	-1.9	-0.2	1.7
8	-15.3	-8.6	-1.9	-0.3	1.6
10	-15.3	-8.6	-1.9	-0.4	1.5
12	-15.2	-8.5	-1.8	-0.4	1.4
14	-15.2	-8.5	-1.8	-0.4	1.4
16	-15.2	-8.5	-1.8	-0.5	1.3
18	-15.2	-8.5	-1.8	-0.5	1.2
20	-15.2	-8.5	-1.8	-0.5	1.2
22	-15.2	-8.5	-1.8	-0.6	1.2
24	-15.1	-8.4	-1.7	-0.6	1.1
26	-15.1	-8.4	-1.7	-0.6	1.1
28	-15.1	-8.4	-1.7	-0.6	1.1
30	-15.1	-8.4	-1.7	-0.6	1.0

distribution which makes a best fit to the actual distribution. The change is significant in cases where two or more of the noise contributions are of approximately equal magnitude. The calculations are rather complicated, but are given in detailed form in the NTIA report.

The results from IONCAP are substantially changed by the new noise model. The effect of the new noise measurements is illustrated in the NTIA Report 87-212 by a table, reproduced here as Table II, giving the difference between new and old values of man-made and galactic noise values. The report also includes sample IONCAP Method 23 output to illustrate the differences in Signal, Noise, and S/N caused by the new data and calculational methods. The differences caused by the new technique for summing noise are significant but apparently generally not as large as those caused by the change in data. They are also illustrated in the report by Method 23 output sheets, which are calculated using the new data and both the new and the old calculational techniques.

The documentation of the Updated Noise Model provided by Spaulding and Stewart includes listings of new versions of the IONCAP subroutines GENOIS, ANOIS1, NOISY, and GENFAM, which are reproduced here as Appendix B. The essential changes are in the long-term data base and in GENOIS, both of which have been incorporated into the Modified IONCAP program. The other three subroutines, whose listings differ slightly from their forms in IONCAP 85.04, appear to contain no computational differences which would affect the output data.

D. A Change in Output of System Performance Table (Method 20) Quantities

This modification affects the output of six system performance variables which are calculated in Methods 16 - 23. The quantities are those identified in the tabulations as V HITE, LOSS, DBU, S DBW, SNR, AND RPWRG. In IONCAP 85.04 these quantities are floating point variables whose values have been truncated to integer values before writing to output. In the Modified IONCAP, these quantities have been rounded to the nearest integer. They thus more accurately approximate the calculated values, and can differ from the values in IONCAP 85.04 by as much as unity. In addition, the output format for five the the quantities has been changed from F4.0 to I4 (i.e., a decimal point no longer occupies one of the four spaces allotted to each quantity), which prevents overflows when a quantity is -100 or less, or 1000 or greater.

These modifications were made in subroutine OUTBOD. The FORTRAN variables VHIGH, DBLOS, DBU, DBW, SNDB, and SNPR correspond, respectively, to the tabulated values designated V HITE, LOSS, DBU, S DBW, SNR, and RPWRG. The variables whose output format was changed to I4 are VHIGH, DBLOS, DBU, SNDB, and SNPR.

Figure 5 contains a listing a data file used to depict the change in output. Figures 6a and 6b show the outputs from IONCAP 85.04 and from the Modified IONCAP, respectively.

```
IONOSPHERIC COMMUNICATIONS ANALYSIS AND PREDICTION PROGRAM - IONCAP   VERSION 85 04

         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890

METHOD        20
MONTH       1988     6
SUNSPOT    120.0
LABEL      UTICA, NY to PETERSON AFB, CO
CIRCUIT    43.08N     75.14W     38.56N     104.38W          0
SYSTEM       1.0   -3.    0.1   90.    12.    10.     5.
ANTENNA        1     2          .001    4.           10.
ANTENNA        2     2          .001    4.           10.
FREQUENCY    2.0   3.0   5.0   7.5  10.0  12.5  15.0  17.5  20.0  25.0  30.0
TIME          16    24    12
FPROB        1.0   1.0   1.0   1.0
EXECUTE
QUIT
```


Figure 5. Input data file used to illustrate the differences between IONCAP 85.04 and Modified IONCAP with Method 20 output data. Both programs were run using the long-term data base which includes the updated noise model.

```
                                    METHOD 20    IONCAP 85.04    PAGE    1

          JUN     1988              SSN = 120.
UTICA, NY to PETERSON AFB, CO                    AZIMUTHS              N  MI.        KM
43.08 N    75.14 W - 38.56 N  104.38 W     268.39    69.62          1348.7    2497.6
                                    MINIMUM ANGLE    0.1  DEGREES
ITS- 1 ANTENNA PACKAGE
XMTR    2.0  TO  30.0  VER MONOPOLE H     0.00 L    10.00 A     0.0  OFF AZ     0.0
RCVR    2.0  TO  30.0  VER MONOPOLE H     0.00 L    10.00 A     0.0  OFF AZ     0.0
POWER =    1.000 KW  3 MHZ NOISE = -148.0 DBW   REQ. REL = .90  REQ. SNR = 12.0
MULTIPATH POWER TOLERANCE = 10.0 DB   MULTIPATH DELAY TOLERANCE =  5.000 MS

 UT  MUF

16.0 19.0   2.0   3.0   5.0   7.5  10.0  12.5  15.0  17.5  20.0  25.0  30.0 FREQ
       1F2   2 E   2 E   2ES   2ES   2F2   2F1   1F2   1F2   1F2   2ES   2ES MODE
      16.2   4.4   4.8   7.1   7.1  31.8  17.4  15.6  16.2  16.2   7.1   7.1 ANGLE
       9.3   8.4   8.5   8.5   8.5  10.5   9.0   9.3   9.3   9.3   8.5   8.5 DELAY
      521.   79.   84.  110.  110.  446.  235.  507.  521.  521   110.  110. V HITE
      0.14  1.00  1.00  0.98  0.96  0.96  1.00  0.56  0.26  0.08  0.10  0.02 F DAYS
      153.  440.  408.  280.  226.  169.  175.  147.  149.  158.  192.  222. LOSS
       16.  ****  ****  ****  -41.   -7.   -8.   18.   15.    7.  -23.  -50. DBU
     -118  -410  -377  -250  -168  -135  -140  -113  -116  -125  -162  -192 S DBW
     -170  -152  -153  -156  -159  -161  -164  -166  -168  -170  -173  -175 N DBW
       51.  ****  ****  -94.  -10.   25.   24.   53.   52.   45.   11.  -17. SNR
      -13.  282.  248.  118.   47.   13.    8.  -17.  -14.   -7.   27.   54. RPWRG
     0.97  0.00  0.00  0.00  0.01  0.74  0.77  0.99  0.98  0.95  0.48  0.08 REL
     0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00 MPROB
     0.63  0.00  0.00  0.00  0.06  0.33  0.35  0.71  0.64  0.57  0.19  0.04 S PRB
       25.   10.   10.   10.   25.   25.   19.   23.   25.   25.   25.   25. SIG LW
       15.    1.    1.    1.    8.   10.   12.    8.   13.   20.   21.   25. SIG UP
       16.  ****  ****  ****  -41.   -7.   -8.   18.   15.    7.  -23.  -50. VHFDBU
       25.   10.   10.   10.   25.   25.   19.   23.   25.   25.   25.   25. VHF LW
       15.    1.    1.    1.    8.   10.   12.    8.   13.   20.   21.   25. VHF UP
        F     E     E    ES    ES    F2    F1    F2    F2     F     F    ES VHFMOD
       26.   12.   12.   12.   26.   26.   20.   24.   26.   26.   26.   26. SNR LW
       17.    9.    9.    9.   12.   14.   15.   12.   16.   22.   23.   26. SNR UP
```

Figure 6a. IONCAP 85.04 Method 20 output data obtained with the input data of Figure 5.

```
                                    METHOD 20    IONCAP 88.01    PAGE    1

          JUN     1988              SSN = 120.
 UTICA, NY to PETERSON AFB, CO                  AZIMUTHS          N MI.        KM
 43.08 N    75.14 W - 38.56 N  104.38 W     268.39    69 02     1348.7     2497.6
                                    MINIMUM ANGLE    0.1  DEGREES
 ITS- 1 ANTENNA PACKAGE
 XMTR    2.0  TO  30.0  VER MONOPOLE H     0.00 L    10.00 A     0.0  OFF AZ     0.0
 RCVR    2.0  TO  30.0  VER MONOPOLE H     0.00 L    10.00 A     0.0  OFF AZ     0.0
 POWER =    1.000 KW  3 MHZ NOISE = -150.0 DBW   REQ. REL = .90  REQ. SNR = 12.0
 MULTIPATH POWER TOLERANCE = 10.0 DB   MULTIPATH DELAY TOLERANCE =  5.000 MS

  UT  MUF

16.0 19.0   2.0   3.0   5.0   7.5  10.0  12.5  15.0  17.5  20.0  25.0  30.0 FREQ
       1F2   2 E   2 E   2ES   2ES   2F2   2F1   1F2   1F2   1F2   2ES   2ES MODE
      16.2   4.4   4.8   7.1   7.1  31.8  17.4  15.6  16.2  16.2   7.1   7.1 ANGLE
       9.3   8.4   8.5   8.5   8.5  10.5   9.0   9.3   9.3   9.3   8.5   8.5 DELAY
       521    79    84   110   110   446   235   507   521   521   110   110 V HITE
      0.14  1.00  1.00  0.98  0.96  0.96  1.00  0.56  0.26  0.08  0.10  0.02 F DAYS
       153   440   408   280   226   169   175   147   149   158   192   222 LOSS
        13  -270  -241  -118   -41    -7    -9    18    12     5   -23   -50 DBU
      -121  -410  -378  -250  -169  -137  -142  -114  -119  -127  -162  -192 S DBW
      -171  -154  -154  -157  -160  -162  -165  -168  -170  -172  -175  -177 N DBW
        51  -256  -223   -93    -9    26    23    54    51    46    13   -15 SNR
       -13   279   246   116    46    11     7   -19   -14    -8    25    52 RPWRG
      0.97  0.00  0.00  0.00  0.02  0.76  0.78  0.99  0.98  0.95  0.52  0.10 REL
      0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00 MPROB
      0.61  0.00  0.00  0.00  0.07  0.32  0.31  0.71  0.64  0.57  0.22  0.05 S PRB
       25.   10.   10.   10.   25.   25.   18.   23.   25.   25.   25.   25. SIG LW
       15.    1.    1.    1.    8.   10.   12.    8.   14.   20.   21.   25. SIG UP
       13.  **** **** **** -41.   -7.   -9.   18.   12.    5.  -23.  -50. VHFDBU
       25.   10.   10.   10.   25.   25.   18.   23.   25.   25.   25.   25. VHF LW
       15.    1.    1.    1.    8.   10.   12.    8.   14.   20.   21.   25. VHF UP
        F     E     E    ES    ES    F2    F1    F2    F2     F     F    ES VHFMOD
       26.   11.   11.   12.   25.   25.   19.   23.   26.   26.   26.   26. SNR LW
       18.   10.   10.   10.   13.   14.   15.   12.   16.   22    24.   27. SNR UP
```

Figure 6b. Modified IONCAP Method 20 output data obtained with the input data of Figure 5. Because of the format changes, DBU and SNR quantities which exceed 99 are printed, where in IONCAP 85.04 overflow stars appear. Because of differences in summing the contributions of different modes, and because of rounding instead of truncating the results, most of the performance quantities produced by the Modified IONCAP show some differences from those produced by IONCAP 85.04.

E. A Change in Procedure for Summing Signal Levels in RELBIL

While signal and noise levels are frequently expressed in logarithmic form, summing several sources of signal or noise requires linear expressions. When the quantities vary over a wide range, transitions between the two forms are at risk of computational overflow because of machine-dependent limitations on the size of permissible numbers. Such overflows sometimes occurred in subroutine RELBIL when IONCAP 85.04 was run on the NRL Space Sciences Division VAX computer, which doesn't allow numbers greater than 1.0E+38. In this subroutine, each of the logarithmic quantities SIGPOW(IM) - TLLOW(IM), SIGPOW(IM), SIGPOW(IM) - TLHGH(IM), and FLDST(IM) is summed over all propagating modes (numbered by IM), producing the sums XDSLW, XSIGS, SDSUP, and XFLD, respectively. In the modified IONCAP, each contribution is normalized to the value of the maximum contribution for the quantity to which it contributes. This change prevents an overflow condition from occurring for certain situations involving very large signals. The effect of this normalization is removed after the summation has been completed and the sums re-converted to logarithmic form.

F. Re-instatement of Long-path System Absorption Values

Subroutine SIGDIS calls subroutine SYSSY(X1, X2, X3, X4, X5, X6, X7, X8, X9), which picks the correct system absorption loss out of the data base. The third parameter is used to declare whether the path is short (X3=2) or long (X3=5). In IONCAP 85.04 variable X3 was fixed, apparently inadvertantly, at 2. In the Modified IONCAP, two new lines have been added to SIGDIS to change X3 to 5 if the path length exceeds 2500 Km.

G. Consolidation of Subroutines for Calculating LUF and System Performance

In IONCAP 85.04, LUF values are calculated from subroutine SHTLUF (for short paths) and GETLUF (for long paths), and the quantitative performances for individual modes are calculated in LUFFY (for short paths) and LNGLUF (for long paths). Since these four subroutines have a substantial number of lines of identical coding, they have been combined into the single subroutine LUFFY(IPFLAG). The subroutine is called with a value of the variable IPFLAG depending on the desired function:

FUNCTION	IPFLAG
Short-path System Performance	100
Long-path System Performance	200
Short-path LUF	300
Long-path LUF	400

Subroutines SHTLUF, GETLUF, and LNGLUF therefore do not appear in the Modified IONCAP program.

H. Restructuring of COMMON Blocks

In IONCAP 85.04, certain COMMON blocks are defined with different lengths in different subprograms. This is permissible on some computers, such as the VAX. On the NRL Cray computer, however, it is required that a given COMMON block have the same length in every subprogram in which it appears. To make the Modified IONCAP program work on the Cray, therefore, COMMON blocks /ANOIS/, /CONTRL/, /DON/, /FRQ/, /METSET/, /RAYS/, /RON/, /SON/, /TIME/, /TON/, /ZON/, /AON/, and /ALPHA/ were modified so that each has the same form in every subprogram in which it appears. COMMON blocks /OUTLAB/, /REFLX/, and /LOSX/ were modified to partially fulfill this criterion.

I. A WRITE-statement in FLOLIN Changed to Prevent Output-Conversion-Overflow Error Messages

In subroutine FLOLIN, which outputs individual lines of circuit reliability data as directed by OUTBOD, data can sometimes not be written into the data file because the number of characters exceeds the number allowed by the output format. Under this non-fatal condition, the output field is filled with asterisks and a warning message is issued. When long IONCAP runs are made, the large number of these messages sometime causes the data file or log file (if the the job is run in batch mode) to be messed up and/or inconveniently long. To prevent these error messages from being written, an IOSTAT specifier was added to the WRITE statements in FLOLIN.

J. A Change in Subroutine Variables: GEOTIM(ITIM,JT) Changed to GEOTIM(JT).

GEOTIM is a subroutine which, given the time JT (in either LMT or GMT) at the transmitter, computes (via function CNGTIM) the local mean time at each of the five ionospheric reflection points used by IONCAP. The parameter ITIM, which is read in on the TIME Control Card and which indicates whether calculations have been requested for GMT or LMT times, has been added to the /TIME/ Common Block, and thus is not required as an explicit variable in GEOTIM.

K. Additional RETURN Statements Added in SELRCR and SELTMT

A RETURN statement was added in the Modified IONCAP to subroutines SELRCR and SELTMT to teminate operation of these subroutines when an over-the-MUF mode has been calculated. This was done because that situation sometimes resulted in a fatal arithmetic (dividing by zero) error. It would be possible to devise a more sophisticated way to alleviate this difficulty.

L. Change of Version Number

In IONCAP 85.04 the version number variable VERSN is set to 85.04 in both Program IONCAP.FOR and the block data module BLKDAT.FOR. In the Modified IONCAP the variable is set to 88.01 in BLKDAT.FOR, and the duplicate statement in IONCAP.FOR was removed.

M. Format Changes to Accomodate Line Printers with 132 Characters/Line

In IONCAP 85.04 the Vertical-incidence ionogram format was designed for a 135-column line printer. In the Modified IONCAP a slight modification was made in subroutine IONPLT.FOR to permit the ionogram to be displayed on a 132-column printer.

For the same reason, the Modified IONCAP includes a format change in subroutine OUTANT. In the FORMAT statement which controls output of the antenna gain pattern, the elevation angle scale and legend on the right-hand side are omitted so that the output can be written in 131 columns rather than 136.

The Modified IONCAP includes a similar change in subroutine OUTPAR, which includes FORMAT statements which controls the output of data on each ionospheric reflection point. In IONCAP 85.04, the format for this output required a printer with 135 characters per line. In the Modified IONCAP the FORMAT statements were changed to permit use of a printer with 132 characters per line.

N. A Branching Criterion Changed in LECDEN

Subroutine LECDEN includes a branching point whose outcome depends on the relative heights of two electron density profiles. If the quantities being compared are close, the outcome can depend on the precision of the computer. This circumstance apparently caused the sample input data (from the ITIS IONCAP 78.01 User's Manual), when calculated with the NRL SSDVAX computer, to yield results different from the ITIS sample output data, which had been calculated with an HP1000 computer. The addition of a small increment (0.00001) to one of the quantities being tested changed the results so that the NRL results agree with the sample results.

O. Removal of Documentation from Source Code

In IONCAP 85.04, the main IONCAP program contained about three pages of information describing the program, its purposes and development. When it was decided to adapt the program to a desk-top computer at NRL, it became necessary to shorten the source code as much as possible. Thus those comments were removed and retained as a separate file named IONCAP.DOC. The D-comment statement

```
D     INCLUDE 'IONCAP.DOC/LIST"
```

was then inserted into IONCAP so that when the source code is compiled, the descriptive information may be included in the listing, if desired, by adding the command qualifier /D_LINES.

P. Subroutine MAKDAT.FOR for Generating Standard Antenna Patterns

VOA requirements for propagation predictions over a wide area resulted in a need for antenna patterns other than those provided in IONCAP 85.04. Separate transmitter and receiver antenna patterns were thus adopted by VOA as standards. A FORTRAN program MAKDAT.FOR was also provided by VOA to generate a file named TAPE26, which contains the antenna pattern data required by IONCAP. The following two paragraphs briefly describe the standard antenna patterns, and a listing of MAKDAT.FOR is provided in section VI.

The standard receiver pattern is assumed to be the equivalent of a 3-foot whip with a ground plane of sixty 3-foot radials. According to information provided by VOA, the elevation radiation pattern of this azimuthally isotropic antenna can be derived from measured and calculated data published by the U.S. Army Signal Radio Propagation Agency. The antenna pattern is illustrated in Figure 7, and tabulated in Table 3.

The standard transmitting antenna is assumed to be azimuthally isotropic, with an elevation dependence derived from values tabulated below. The gains for non-integral elevation angles below 5 degrees are determined by linear interpolation.

Elevation angle [Degrees]	Gain [dB]
1	-26
2	5
3	10
4	15
5	17
5-90	17

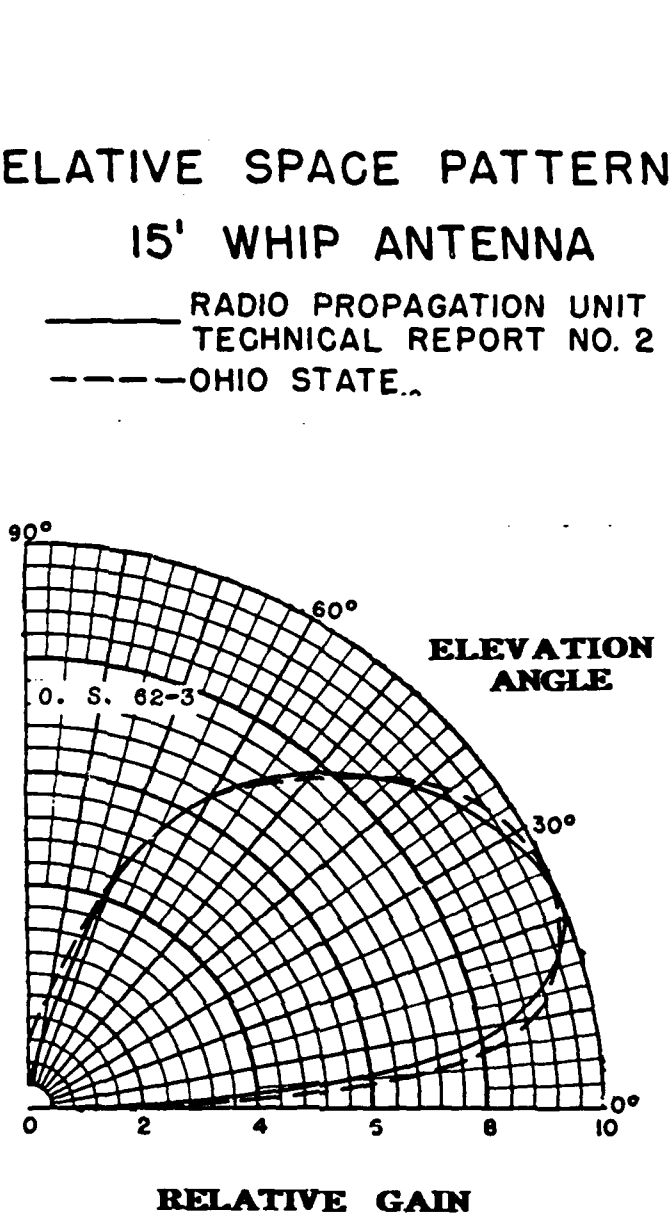

Figure 7. Receiver antenna pattern adopted as a standard by VOA. The figure displays the dependence of gain on elevation angle of the incoming HF wave, derived from measurements made at 2.03MHz. The gain is isotropic in azimuthal angle.

TABLE 3. Tabulated Values of Gain as a Function of Elevation Angle for the Standard VOA Receiver Antenna. At Elevation Angles Between the Values Shown, Linear Interpolation Shall be Used.

ELEVATION ANGLE	GAIN [dBi]	ELEVATION ANGLE	GAIN [dBi]
0^0	-20.0	48^0	- 2.0
1^0	-14.0	49^0	- 2.1
2^0	-11.0	50^0	- 2.3
3^0	- 7.6	51^0	- 2.4
4^0	- 5.4	52^0	- 2.6
5^0	- 4.0	53^0	- 2.7
6^0	- 3.2	54^0	- 2.9
7^0	- 2.5	55^0	- 3.1
8^0	- 1.8	56^0	- 3.2
9^0	- 1.6	57^0	- 3.4
10^0	- 1.3	58^0	- 3.6
11^0	- 1.1	59^0	- 3.7
12^0	- 0.9	60^0	- 3.9
13^0	- 0.6	61^0	- 4.2
14^0	- 0.5	62^0	- 4.4
15^0	- 0.4	63^0	- 4.7
16^0	- 0.2	64^0	- 5.0
17^0	- 0.1	65^0	- 5.4
18^0	- 0.0	66^0	- 5.7
to		67^0	- 6.0
25^0	- 0.0	68^0	- 6.4
26^0	- 0.1	69^0	- 6.7
27^0	- 0.2	70^0	- 7.1
28^0	- 0.2	71^0	- 7.5
29^0	- 0.2	72^0	- 7.9
30^0	- 0.3	73^0	- 8.4
31^0	- 0.3	74^0	- 8.8
32^0	- 0.4	75^0	- 9.3
33^0	- 0.5	76^0	- 9.8
34^0	- 0.5	77^0	-10.4
35^0	- 0.6	78^0	-10.9
36^0	- 0.7	79^0	-11.4
37^0	- 0.8	80^0	-12.0
38^0	- 0.8	81^0	-12.6
39^0	- 0.9	82^0	-13.2
40^0	- 1.0	83^0	-13.9
41^0	- 1.1	84^0	-14.6
42^0	- 1.2	85^0	-15.4
43^0	- 1.4	86^0	-16.2
44^0	- 1.5	87^0	-17.2
45^0	- 1.6	88^0	-18.2
46^0	- 1.8	89^0	-19.6
47^0	- 1.9	90^0	-21.9

III. SOME AIDS TO IONCAP DOCUMENTATION

The computer work for this report was done on the NRL Space Sciences Division VAX SSDVAX. The IONCAP 85.04 source code modules are stored in the directory USD1:[VOALIB.IONCAP.SOURCE.ORIG], and the Modified IONCAP source code modules are stored in the directory USD1:[VOALIB.NEWCAP.SOURCE]. Concatenated source codes are contained in the files

```
USD1:[VOALIB.IONCAP.SOURCE]ALL.FOR      (IONCAP 85.04)
USD1:[DAEHLER]ALLNEW.FOR                (Modified IONCAP).
```

Executable versions of the IONCAP programs are contained in the files

```
USD1:[VOALIB.IONCAP]IONCAP.EXE          (IONCAP 85.04)
USD1:[DAEHLER]ALLNEW.EXE                (Modified IONCAP).
```

The original long-term data base acquired with IONCAP 85.04 is contained in the files

```
          USD1:[VOALIB.IONCAP.SOURCE]IONCAP_LTD.ASCII;1  (ASCII version)
and       USD1:[VOALIB.IONCAP]IONCAP.LTD;1               (binary version).
```

The long-term data base containing the Updated Noise Model is contained in the files

```
          USD1:[VOALIB.NUNOIS]NEW_LTD.ASCII;1     (ASCII version)
and       USD1:[VOALIB.IONCAP]NEW_IONCAP.LTD;1    (binary version).
```

When running IONCAP to obtain sample output data, the following command procedures were used:

```
USD1:[VOALIB]IONCAP.COM                 (IONCAP 85.04)
USD1:[VOALIB.IONCAP]NEWCAP.COM          (Modified IONCAP).
```

Two charts (Figures 8 and 9) and Table 4 were created because their information was found useful in understanding the flow of calculations in IONCAP and in documenting the changes by which IONCAP 85.04 became the Modified IONCAP program. Figure 8 shows graphically all of the subprograms called by each subprogram in the Modified IONCAP program. Figure 9 attempts to show, for each subprogram, both the subprograms which are called by, and which subprograms call, that subprogram.

Table 4 is a listing of the information from which Figures 8 and 9 were created. The data were extracted from the concatenated version of the Modified IONCAP source code (USD1:[DAEHLER]ALLNEW.FOR, and the line numbers refer to lines in that file. For each subprogram, Table 4 lists:

a. The lines of ALLNEW.FOR which contain the listing of the specified subprogram;

b. Whether the specified subprogram is a program, subroutine, function, or block data;

c. The line number and subprogram name of every call to the specified subprogram;

d. The names of all subprograms called by the listed subprogram, and the line numbers of those calls.

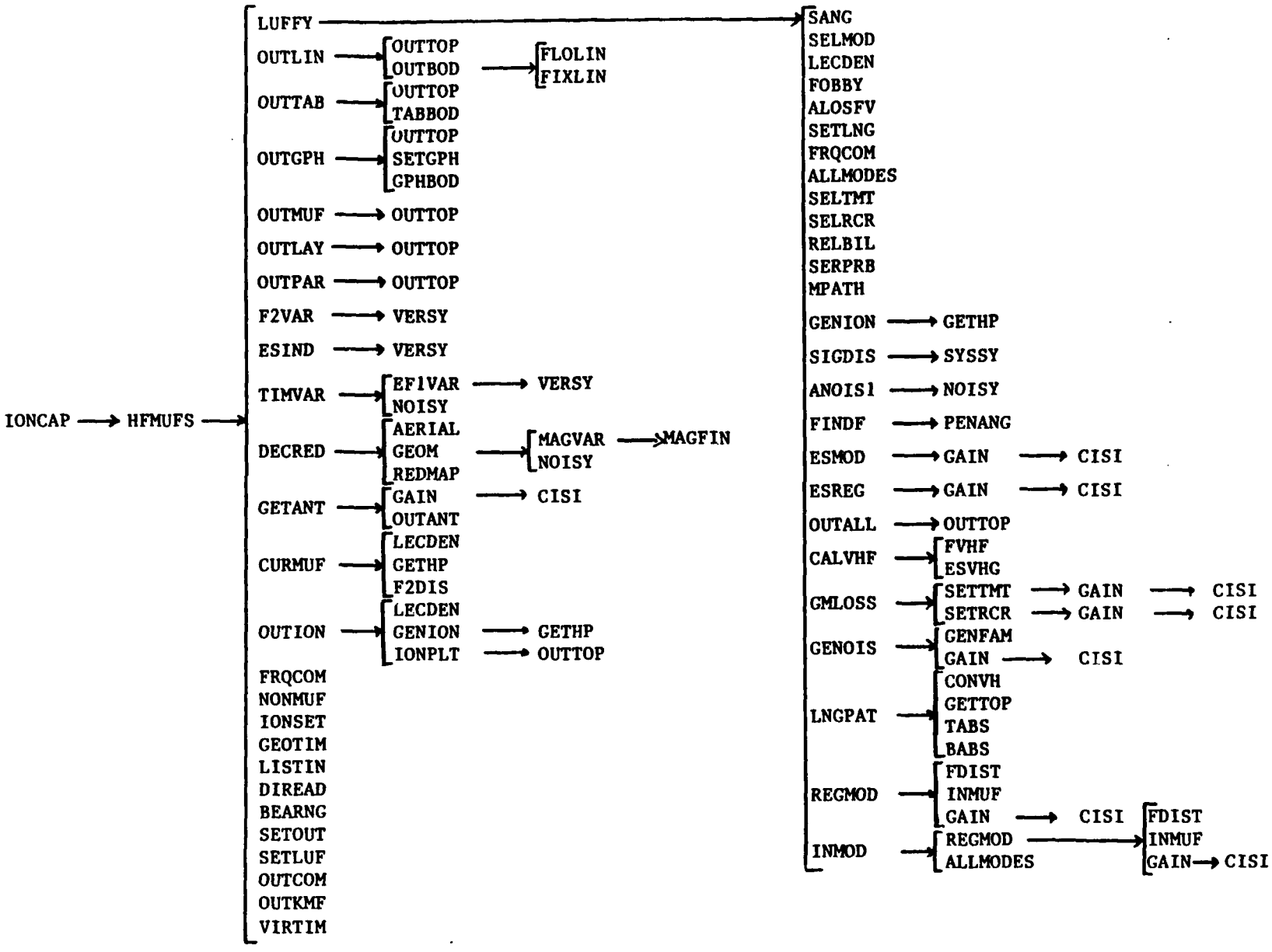

Figure 8. Direction of flow through the subprograms of the Modified IONCAP program.

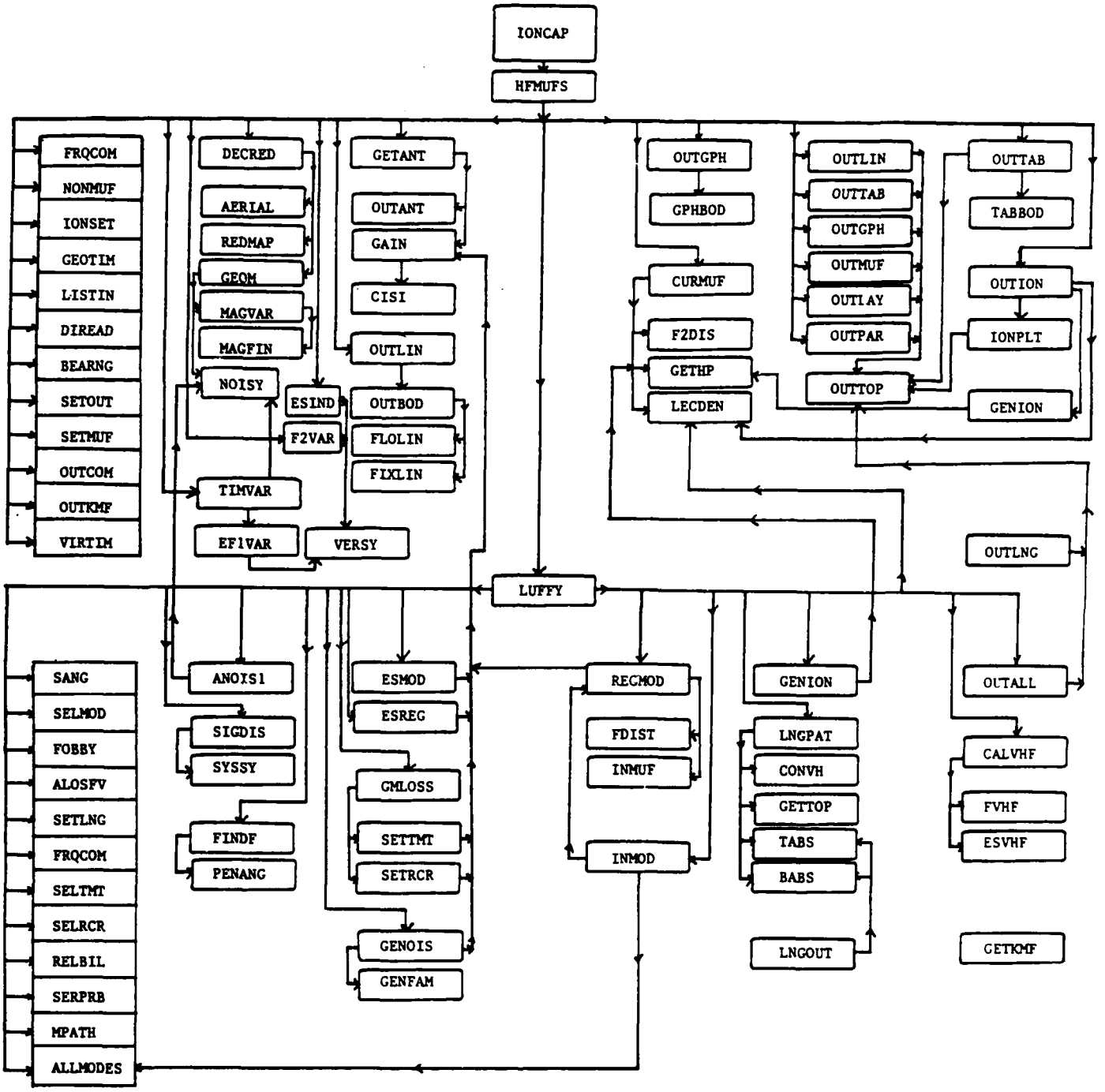

Figure 9. Direction of flow through the subprograms of the Modified IONCAP program, indicating also all of the subprograms which call a given subprogram.

Table 4: Subprograms of the Modified IONCAP program, showing the subroutines and line numbers (in ALLNEW.FOR) from which each is called, and the subprograms which each one calls. See Section III for detailed description.

Filename/ Line #'s	File Type	CALLed in L.#	& SUBR.		Subroutines CALLed and the Line #
AERIAL.FOR (2-183)	SUBR.	1643	DECRED	-	NONE
ALLMODES.FOR (185-270)	SUBR.	5501	INMOD	-	
		5572	INMOD	-	
		6724	LUFFY	-	NONE
		6756	LUFFY	-	
		6770	LUFFY	-	
		6786	LUFFY	-	
ALOSFV.FOR (272-396)	SUBR.	6679	LUFFY	-	NONE
ANOIS1.FOR (398-447)	SUBR.	6696	LUFFY	-	NOISY (2)-L# 444,445
BABS.FOR (449-482)	SUBR.	6400	LNGOUT	-	
		6413	LNGOUT	-	NONE
		6492	LNGPAT	-	
BEARNG.FOR (484-526)	SUBR.		HFMUFS	-	NONE
BENDY.FOR (528-539)	FUNC.	537	BENDY	-	
		1084	CURMUF	-	NONE
		4229	GENION	-	
BLKDAT.FOR (541-784)	BLOCK DATA	NONE		-	NONE
CALVHF.FOR (786-844)	SUBR.	6809	LUFFY	-	FVHF-L# 827; ESVHF-L# 829
CISI.FOR (846-882)	SUBR.	3786	GAIN	-	
		3787	GAIN	-	
		3997	GAIN	-	NONE
		3999	GAIN	-	
		4028	GAIN	-	
		4029	GAIN	-	
CNGTIM.FOR (884-939)	FUNC.	910	CNGTIM	-	
		927	CNGTIM	-	
		4663	GEOTIM	-	
		4669	GEOTIM	-	NONE
		4679	GEOTIM	-	
		4686	GEOTIM	-	
		6389	CNGTIM	-	

Table 4: Subprograms of the Modified IONCAP program.

Filename/ Line #'s	File Type	CALLed in L.# & SUBR.		Subroutines CALLed and the Line #
CONVH.FOR (941-957)	SUBR.	6472	LNGPAT -	NONE
CURMUF.FOR (959-1315)	SUBR.	5320	HFMUFS -	LECDEN-L# 1004; GETHP (3)-L# 1026, 1079, & 1171; F2DIS (2)- L# 1135 & 1141
DECRED.FOR (1317-1977)	SUBR.	5223	HFMUFS -	REDMAP-L# 1537; AERIAL-L# 1643; GEOM L# 1699
DIREAD.FOR (1979-1990)	SUBR.	5220	HFMUFS -	NONE
EF1VAR.FOR (1992-2054)	SUBR.	10400	TIMVAR -	VERSY-L# 2017
ESIND.FOR (2056-2084)	SUBR.	5304	HFMUFS -	VERSY-L# 2075
ESMOD.FOR (2086-2296)	SUBR.	6767	LUFFY -	GAIN (3)-L# 2236, 2242, & 2243
ESREG.FOR (2298-2656)	SUBR.	6769	LUFFY -	GAIN (3)-L# 2581, 2583, & 2595
ESVHF.FOR (2658-2811)	SUBR.	829	CALVHF -	NONE
F2DIS.FOR (2813-2865)	SUBR.	1135	CURMUF -	NONE
		1141	CURMUF -	
F2VAR.FOR (2867-2937)	SUBR.	5301	HFMUFS -	VERSY-L# 2883
FDIST.FOR (2941-3036)	SUBR.	8604	REGMOD -	NONE
FINDF.FOR (3038-3254)	SUBR.	6729	LUFFY -	
		6775	LUFFY -	PENANG-L# 3100
		6777	LUFFY -	
FIXLIN.FOR (3256-3280)	SUBR.	7656	OUTBOD -	
		7664	OUTBOD -	
		7669	OUTBOD -	
		7674	OUTBOD -	NONE
		7677	OUTBOD -	
		7682	OUTBOD -	
		7687	OUTBOD -	

Table 4: Subprograms of the Modified IONCAP program.

Filename/ Line #'s	File Type	CALLed in L.# & SUBR.			Subroutines CALLed and the Line #
FLOLIN.FOR (3282-3307)	SUBR.	7646	OUTBOD	-	NONE
		7648	OUTBOD	-	
		7651	OUTBOD	-	
		7659	OUTBOD	-	
		7690	OUTBOD	-	
		7693	OUTBOD	-	
		7696	OUTBOD	-	
		7699	OUTBOD	-	
		7702	OUTBOD	-	
		7705	OUTBOD	-	
		7708	OUTBOD	-	
		7711	OUTBOD	-	
		7722	OUTBOD	-	
		7725	OUTBOD	-	
FNORML.FOR (3309-3335)	FUNC.	3333	FNORML	-	NONE
		8902	RELBIL	-	
		8994	RELBIL	-	
		9319	SERPRB	-	
FOBBY.FOR (3337-3367)	SUBR.	6677	LUFFY	-	NONE
FRQCOM.FOR (3369-3467)	SUBR.	5330	HFMUFS	-	NONE
		6700	LUFFY	-	
FVHF.FOR (3469-3548)	SUBR.	827	CALVHF	-	NONE
GAIN.FOR (3550-4062)	SUBR.	2236	ESMOD	-	CISI (6)-L# 3786, 3787, 3997, 3999, 4028, & 4029
		2242	ESMOD	-	
		2243	ESMOD	-	
		2581	ESREG	-	
		2583	ESREG	-	
		2595	ESREG	-	
		4395	GENOIS	-	
		4740	GETANT	-	
		8711	REGMOD	-	
		8719	REGMOD	-	
		8722	REGMOD	-	
		9808	SETRCR	-	
		9813	SETRCR	-	
		9975	SETTMT	-	
		9981	SETTMT	-	
GENFAM.FOR (4064-4116)	SUBR.	4313	GENOIS	-	NONE
		4314	GENOIS	-	
GENION.FOR (4118-4242)	SUBR.	6675	LUFFY	-	GETHP (2)-L# 4203 & 4237
		7774	OUTION	-	
GENOIS.FOR (4244-4448)	SUBR.	6731	LUFFY	-	GENFAM (2)-L# 4313 & 4314; GAIN-L# 4395
		6773	LUFFY	-	

Table 4: Subprograms of the Modified IONCAP program.

Filename/ Line #'s	File Type	CALLed in L.# & SUBR.			Subroutines CALLed and the Line #
GEOM.FOR (4450-4640)	SUBR.	1699	DECRED	-	MAGVAR-L# 4618; NOISY-L# 4628
GEOTIM.FOR (4642-4689)	SUBR.	5289	HFMUFS	-	NONE
GETANT.FOR (4691-4764)	SUBR.	5234	HFMUFS	-	GAIN-L# 4740; OUTANT-L# 4762
GETHP.FOR (4766-4856)	SUBR.	1026	CURMUF	-	NONE
		1079	CURMUF	-	
		1171	CURMUF	-	
		4237	CURMUF	-	
		4203	GENION	-	
GETKMF.FOR (4858-4862)	SUBR.	NONE		-	NONE (This subroutine has not yet been developed-Method 12)
GETTOP.FOR (4864-4916)	SUBR.	6486	LNGPAT	-	NONE
GMLOSS.FOR (4918-4979)	SUBR.	6779	LUFFY	-	SETTMT-L# 4961; SETRCR-L# 4963
GPHBOD.FOR (4981-5165)	SUBR.	7761	OUTGPH	-	NONE
HFMUFS.FOR (5167-5445)	SUBR.	5805	IONCAP	-	LISTIN-L# 5214; DIREAD-L# 5220; DECRED-L# 5223; BEARNG (2)-L# 5233 & 5239; GETANT-L# 5234; SETOUT-L# 5237; GEOTIM-L# 5289; VIRTIM-L# 5295 TIMVAR-L# 5299; F2VAR-L#5301; ESIND-L# 5304; OUTPAR-L# 5308; IONSET (2)-L# 5311 & 5315; OUTION-L# 5312; NOMMUF-L# 5317; CURMUF-L# 5320; FRQCOM-L# 5330; LUFFY (2)-L# 5342 & 5349; SETLUF-L# 5343;OUTLIN-L# 5356; OUTTAB-L# 5360; OUTLAY-L# 5363; OUTMUF (2)-L# 5367 & 5415; OUTGPH (2)-L# 5371 & 5420; OUTCOM-L# 5375; OUTKMF-L# 5378
INMOD.FOR (5447-5590)	SUBR.	6764	LUFFY	-	REGMOD (2)-L# 5500 & 5571; ALLMODES (2)-L# 5501 & 5572
INMUF.FOR (5592-5754)	SUBR.	8607	REGMOD	-	NONE
IONCAP.FOR (5756-5808)	PRGM.	NONE		-	HFMUFS-L# 5805
IONPLT.FOR (5810-5972)	SUBR.	7775	OUTION	-	OUTTOP-L# 5855

Table 4: Subprograms of the Modified IONCAP program.

Filename/ Line #'s	File Type	CALLed in L.# & SUBR.			Subroutines CALLed and the Line #
IONSET.FOR (5974-6036)	SUBR.	5311	HFMUFS	-	NONE
		5315	HFMUFS	-	
LECDEN.FOR (6038-6225)	SUBR.	1004	CURMUF	-	
		6673	LUFFY	-	NONE
		7773	OUTION	-	
LISTIN.FOR (6227-6364)	SUBR.	5214	HFMUFS	-	NONE
LNGOUT.FOR (6366-6425)	SUBR. (Must of been replaced)	NONE		-	TABS (2)-L# 6399 & 6412; BABS (2)-L# 6400 & 6413
LNGPAT.FOR (6427-6568)	SUBR.	6785	LUFFY	-	CONVH-L# 6472; GETTOP-L# 6486; TABS-L# 6491; BABS-L# 6492
LUFFY.FOR (6570-6847)	SUBR.	5342	HFMUFS	-	SANG-L# 6662; SELMOD-L# 6664;LECDEN-L# 6673; GENION-L# 6675; FOBBY-L# 6677; ALOSFV-L# 6679;SETLNG-L# 6683; SIGDIS-L# 6694; ANOIS1-L# 6696; FRQCOM-L# 6700;ALLMODES (4)-L# 6724, 6756, 6770, & 6786; FINDF (3)-L# 6729, 6775, & 6777; GENOIS (2)-L# 6731 & 6773; REGMOD-L# 6754; INMOD-L# 6764; ESMOD-L# 6767; ESREG-L# 6769; GMLOSS-L# 6779;SELTMT-L# 6781; SELRCR-L# 6783; LNGPAT-L# 6785; RELBIL-L# 6790; SERPRB-L# 6795; MPATH-L# 6799; OUTALL-L# 6807; CALVHF-L# 6809
		5349	HFMUFS	-	
MAGFIN.FOR (6849-6944)	SUBR.	6976	MAGVAR	-	NONE
MAGVAR.FOR (6946-6988)	SUBR.	4618	GEOM	-	MAGFIN-L# 6976
MONITR.FOR (6990-7033)	FUNC.	1446	DECRED	-	
		1449	DECRED	-	
		1843	DECRED	-	
		1948	DECRED	-	
		6246	LISTIN	-	NONE
		6282	LISTIN	-	
		6287	LISTIN	-	
		6296	LISTIN	-	
		7027	MONITR	-	
		7030	MONITR	-	
MPATH.FOR (7035-7071)	SUBR.	6799	LUFFY	-	NONE

Table 4: Subprograms of the Modified IONCAP program.

Filename/ Line #'s	File Type	CALLed in L.# & SUBR.			Subroutines CALLed and the Line #
NOISY.FOR (7073-7141)	SUBR.	444	ANOIS1	-	NONE
		445	ANOIS1	-	
		4628	GEOM	-	
		10408	TIMVAR	-	
NOMMUF.FOR (7143-7235)	SUBR.	5317	HFMUFS	-	NONE
OUTALL.FOR (7237-7409)	SUBR.	6807	LUFFY	-	OUTPAR-L# 7303; OUTTOP (2)-L# 7307 & 7367
OUTANT.FOR (7411-7533)	SUBR.	4762	GETANT	-	NONE
OUTBOD.FOR (7535-7731)	SUBR.	7831	OUTLIN	-	FLOLIN (14)-L# 7646,7648,7651,7659, 7690,7693,7696,7699,7702,7705,7708, 7711,7722 & 7725; FIXLIN (7)-L# 7656,7664,7669,7674,7677,7682 & 7687
OUTCOM.FOR (7733-7747)	SUBR.	5375	HFMUFS	-	NONE
OUTGPH.FOR (7749-7763)	SUBR.	5371	HFMUFS	-	OUTTOP-L# 7757; SETGPH-L#7759;
		5420	HFMUFS	-	GPHBOD-L# 7761
OUTION.FOR (7765-7778)	SUBR.	5312	HFMUFS	-	LECDEN-L# 7773; GENION-L# 7774; IONPLT-L# 7775
OUTKMF.FOR (7780-7786)	SUBR.	5378	HFMUFS	-	NONE
OUTLAY.FOR (7788-7816)	SUBR.	5363	HFMUFS	-	OUTTOP-L# 7800
OUTLIN.FOR (7818-7833)	SUBR.	5356	HFMUFS	-	OUTTOP-L# 7829; OUTBOD-L# 7831
OUTLNG.FOR (7835-7866)	SUBR. (Must of been replaced)	NONE		-	OUTTOP-L# 7856
OUTMUF.FOR (7868-7948)	SUBR.	5367	HFMUFS	-	OUTTOP-L# 7890
		5415	HFMUFS	-	
OUTPAR.FOR (7950-8020)	SUBR.	5308	HFMUFS	-	OUTTOP-L# 7985
		7303	OUTALL	-	
OUTTAB.FOR (8022-8042)	SUBR.	5360	HFMUFS	-	OUTTOP-L# 8039; TABBOD-L# 8040

Table 4: Subprograms of the Modified IONCAP program.

Filename/ Line #'s	File Type	CALLed in L.# & SUBR.			Subroutines CALLed and the Line #
OUTTOP.FOR	SUBR.	5855	IONPLT	-	
(8044-8189)		7307	OUTALL	-	
		7367	OUTALL	-	
		7757	OUTGPH	-	
		7800	OUTLAY	-	NONE
		7829	OUTLIN	-	
		7856	OUTLNG	-	
		7890	OUTMUF	-	
		7985	OUTPAR	-	
		8039	OUTTAB	-	
PEN.FOR	FUNC.	1085	CURMUF	-	
(8191-8202)		4230	GENION	-	NONE
		8200	PEN	-	
PENANG.FOR	SUBR.	3100	FINDF	-	NONE
(8204-8281)					
PRBMUF.FOR	FUNC.	2209	ESMOD	-	
(8283-8343)		2216	ESMOD	-	
		2222	ESMOD	-	
		2259	ESMOD	-	
		2562	ESREG	-	
		2571	ESREG	-	
		2577	ESREG	-	
		2610	ESREG	-	
		2612	ESREG	-	
		2620	ESREG	-	
		2624	ESREG	-	
		2629	ESREG	-	
		2637	ESREG	-	
		2641	ESREG	-	
		2646	ESREG	-	
		3520	FVHF	-	
		5588	INMOD	-	
		6541	LNGPAT	-	
		6544	LNGPAT	-	NONE
		6547	LNGPAT	-	
		8341	PRBMUF	-	
		8693	REGMOD	-	
		8699	REGMOD	-	
		8704	REGMOD	-	
		8745	REGMOD	-	
		8753	REGMOD	-	
		8758	REGMOD	-	
		8773	REGMOD	-	
		9799	SETRCR	-	
		9823	SETRCR	-	
		9965	SETTMT	-	
		9990	SETTMT	-	
		10124	SIGDIS	-	
		10132	SIGDIS	-	

Continued on Next Page

Table 4: Subprograms of the Modified IONCAP program.

Filename/ Line #'s	File Type	CALLed in L.# & SUBR.			Subroutines CALLed and the Line #
PRBMUF.FOR	SUBR.	10143	SIGDIS	-	Cont'd.from Previous Page
		10148	SIGDIS	-	
		10159	SIGDIS	-	NONE
		10164	SIGDIS	-	
REDMAP.FOR (8345-8526)	SUBR.	1537	DECRED	-	NONE
REGMOD.FOR (8528-8799)	SUBR.	5500	INMOD	-	FDIST-L# 8604; INMUF-L# 8607;
		5571	INMOD	-	GAIN (3)-L# 8711, 8719, & 8722
		6754	LUFFY	-	
RELBIL.FOR (8801-9016)	SUBR.	6790	LUFFY	-	NONE
SANG.FOR (9018-9060)	SUBR.	6662	LUFFY	-	NONE
SELMOD.FOR (9062-9098)	SUBR.	6664	LUFFY	-	NONE
SELRCR.FOR (9100-9163)	SUBR.	6783	LUFFY	-	NONE
SELTMT.FOR (9165-9239)	SUBR.	6781	LUFFY	-	NONE
SERPRB.FOR (9241-9330)	SUBR.	6795	LUFFY	-	NONE
SETGPH.FOR (9332-9407)	SUBR.	7759	OUTGPH	-	NONE
SETLNG.FOR (9409-9495)	SUBR.	6683	LUFFY	-	NONE
SETLUF.FOR (9497-9534)	SUBR.	5343	HFMUFS	-	NONE
SETOUT.FOR (9536-9683)	SUBR.	5237	HFMUFS	-	NONE
SETRCR.FOR (9685-9831)	SUBR.	4963	GMLOSS	-	GAIN (2)-L# 9808 & 9813
SETTMT.FOR (9833-9999)	SUBR.	4961	GMLOSS	-	GAIN (2)-L# 9975 & 9981
SIGDIS.FOR (10001-10171)	SUBR.	6694	LUFFY	-	SYSSY-L# 10044
SYSSY.FOR (10173-10236)	SUBR.	10044	SIGDIS	-	NONE

Table 4: Subprograms of the Modified IONCAP program.

Filename/ Line #'s	File Type	CALLed in L.# & SUBR.			Subroutines CALLed and the Line #
TABBOD.FOR (10238-10324)	SUBR.	8040	OUTTAB	-	NONE
TABS.FOR (10326-10356)	SUBR.	6399	LNGOUT	-	
		6412	LNGOUT	-	NONE
		6491	LNGPAT	-	
TIMVAR.FOR (10358-10419)	SUBR.	5299	HFMUFS	-	EF1VAR-L# 10400; NOISY-L# 10408
VERSY.FOR (10421-10514)	SUBR.	2017	EF1VAR	-	
		2075	ESIND	-	NONE
		2883	F2VAR	-	
VIRTIM.FOR (10516-10575)	SUBR.	5295	HFMUFS	-	NONE
XLIN.FOR (10577-10610)	FUNC.	4222	GENION	-	
		5511	INMOD	-	
		10084	SIGDIS	-	
		10588	XLIN	-	NONE
		10595	XLIN	-	
		10603	XLIN	-	
		10608	XLIN	-	

(NOTE: File Type FUNC. are not CALLed in, but Used in the listed subroutines.)

IV. LISTING OF THE NEW SUBROUTINE ALLMODES.FOR

```
      SUBROUTINE ALLMODES(iflg,fval)
C
C     THIS ROUTINE outputs THE binary values for the allmodes method
c
      COMMON/ANOIS/ATNU,ATNY,CC,TM,RCNSE,DU,DL,SIGM,SIGU,SIGL,KJ,JK
      COMMON / CONTRL / IELECT(3), KTOUT(12), MONTHS(12), SUNSP(12),
     A IANTOU, ICARD, INTEG, IRED, ISOUT, ISPROC, ISSN, ITYPE, JDASH,
     B JFREQ, JLONG, KCARD, KRUN, MAPIN, MAXNAM, MONOLD, MOREM, MORES,
     C NUMNAM, NUPROC, MAXMET, mspec, ml00
      COMMON /TON /ADJ, ADS, GNOS, GOT, PWRDB, REL, SL, SLS
     1, SPR, SU, SUS, XNOISE, ZNOISE, NF
      COMMON / ZON / ABPS(7), CREL(7), EFF(7), FLDST(7), GRLOS(7),
     1 HN(7), HP(7), PROB(7), RELY(7), RGAIN(7), SIGPOW(7), SN(7),
     2 SPRO(7), TGAIN(7), TIMED(7), TLOSS(7), B(7), FSLOS(7), ADV(7),
     3 OBF(7),NMODE(7),TLLOW(7),TLHGH(7)
      COMMON / allMODE /zABPS(20),zCREL(20),zFLDST(20),zHN(20),zHP(20),
     1zPROB(20),zRELY(20),zRGAIN(20),zSIGPOW(20),zSN(20),
     2zSPRO(20),zTGAIN(20),zTIMED(20),zTLOSS(20),zB(20),zFSLOS(20),
     CizNMODE(20),zTLLOW(20),zTLHGH(20),zEFF(20),NREL,NMMOD

      common/indicez/ispot,iseaz,ifqn,iour,inmmd(11,24,4,2)
      dimension xb(20)
C
      if(iflg.eq.0)then
        nmmod=0
        do 2 i=1,20
        ztloss(i)=32000.
        ztllow(i)=999.
        ztlhgh(i)=999.
        ZHP(I)=-1
        xb(i)=99.
   2    continue
        freq=fval
        RETURN
      else if(iflg.eq.1)then
        hp(2)=hp(1)
        nmode(2)=nmode(1)
        zTLOSS(2)=32000.
        ist=1
        lst=2
      else if(iflg.eq.2)then
        ist=4
        lst=5
      else
        ist=1
        lst=6
      endif
      do 10 i=ist,lst
      if(hp(i).gt.0.)then
```

```
            nmmod=nmmod+1
            ztloss(nmmod)=tloss(i)
            ztllow(nmmod)=tllow(i)
            ztlhgh(nmmod)=tlhgh(i)
            if(mspec.eq.125)then
              ihn=1000.*hn(i)
              ilay=100.*nmode(i)
              xb(nmmod)=b(i)+ihn+ilay
            else
              zhp(nmmod)=hp(i)
              zcrel(nmmod)=crel(i)
              zrely(nmmod)=rely(i)
              zhn(nmmod)=hn(i)
              iznmode(nmmod)=nmode(i)
              zsn(nmmod)=sn(i)
              zfldst(nmmod)=fldst(i)
              zsigpow(nmmod)=sigpow(i)
              zb(nmmod)=b(i)
              ztimed(nmmod)=timed(i)
              zabps(nmmod)=abps(i)
              zprob(nmmod)=prob(i)
              zrgain(nmmod)=rgain(i)
              ztgain(nmmod)=tgain(i)
              zfslos(nmmod)=fslos(i)
              zspro(nmmod)=spro(i)
              zeff(nmmod)=eff(i)
            endif
          endif
   10     continue
          if(fval.eq.999.)then
            inmmd(ifqn,iour,iseaz,ispot)=NMMOD
            if(nmmod.eq.0)NMMOD=1
            if(mspec.eq.125)write(m100)nmmod,freq,(ztloss(i),xb(i),
         +  ztllow(i),ztlhgh(i),i=1,nmmod),rcnse,du,dl
          ENDIF
          return
          end
```

V. LISTINGS OF FOUR IONCAP SUBROUTINES SUPPORTING THE UPDATED NOISE MODEL

The following pages list the subroutines ANOIS1, NOISY, GENFAM, and GENOIS, as provided in NTIA Report 87-212, which describes the Updated Noise Model for IONCAP. See Section IIC for information regarding the changes made to IONCAP 85.04 in producing the Modified IONCAP program.

```
      SUBROUTINE ANOIS1
C
C     THIS ROUTINE DETERMINES THE 1 MHZ ATMOSPHERIC NOISE
C
C     FOURIER SERIES IN LATITUDE AND LONGITUDE FOR TWO DISCRETE
C     LOCAL TIME BLOCKS
C
      COMMON/ANOIS/ATNU,ATNY,CC,TM,XEFF,RCNSE,DU,DL,SIGM,SIGU,SIGL,KJ,JK
      COMMON /CON /D2R, DCL, GAMA, PI, PI2, PI02, R2D, RZ, VOFL
      COMMON / DON / ALATD, AMIN, AMIND, DLONG, DMP, ERTR,
     1  PMP, PWR, RLAT, RLATD, RLONG, RLONGD, RSN, SIGTR,
     2 TLAT, TLATD, TLONG, TLONGD, FLUX, SSN, ATMNO, D90R, D50R,
     3 D10R, D90S, D50S, D10S
      COMMON /FILES/ LUO,LUI,LU25,LU26
      COMMON / TIME / IT, GMT, UTIME(24), GMTR, XLMT(24),ITIM,JTX
      COMMON / TWO / F2D(16,6,6), DUD(5,12,3),FAM(14,12),
     A  SYS(9,16,6), PERR(9,4,6), P(29,16,8),ABP(2,9)
C  LMT AT RCVR SITE
      IF(F2D(1,1,1)) 90, 90, 100
C.....NO IONOSPHERIC LONG TERM DATA BASE FILE
C.....SET NOISE TO ZERO HERE (-204 IN SUBROUTINE GENOIS)
C.....THE USER CAN INPUT ANY VALUE AS MAN-MADE NOISE (RESET IN GENOIS)
   90 ATNU = 0.0
      ATNY = 0.0
      RETURN
  100 CC = GMTR
      KJ= 6
      IF(CC-22.) 105,110,110
  105 KJ = CC/4. +1.
  110 TM = 4*KJ-2
      IF(CC-TM) 115,120,125
  115 JK = KJ -1
      GO TO 130
  120 JK = KJ
      GO TO 130
  125 JK = KJ+1
  130 IF(JK) 135,135,140
  135 JK =6
      GO TO 150
  140 IF(JK-6) 150,150,145
  145 JK = 1
C.....EAST LONGITUDE (IN DEGREES)
  150 CEG= RLONGD
  165 XLA = RLAT * R2D
C.....LATITUDE (IN DEGREES) "+" IS NORTH
      CALL NOISY(KJ,XLA,CEG,ATNU)
      CALL NOISY(JK,XLA,CEG,ATNY)
      RETURN
      END
```

```
      SUBROUTINE NOISY (KJ, XLA, CEG, ANOS)
C     NOISY IS A GENERAL PURPOSE ROUTINE USED TO EVALUATE A FOURIER
C     SERIES IN TWO VARIABLES.
C     KJ --- NUMBER OF FOURIER COEFFICIENT ARRAY TO BE USED
C     XLA --- GEOGRAPHIC LATITUDE, DEGREES,
C     CEG --- GEOGRAPHIC EAST LONGITUDE, DEGREES
C     ANOS --- NOISE VALUE, MEDIAN POWER DB ABOVE KTB
C     ABP --- NORMALIZING FACTORS FOR FOURIER SERIES
C     KJ = 1 TO 6 IS ATMOSPHERIC NOISE, KJ = 7 IS LAND MASS MAP AND
C     KJ = 8 IS RATIO OF F2 HEIGHT OF MAXIMUM TO SEMITHICKNESS
C
C     * NOTE - XLA, CEG, ANOS, ABP ARE NOT ALWAYS AS PREVIOUSLY DEFINED
C     FOURIER VARIABLES AND ATMOSPHERIC RADIO NOISE
C
      COMMON / TWO / F2D(16,6,6), DUD(5,12,5),FAM(14,12),
     A SYS(9,16,6), PERR(9,4,6),P(29,16,8),ABP(2,9)
      COMMON /SWTCH/ INIL,OSSN,OMONTH,OTIME,ODIP,OLAT,OLONG
      DIMENSION SX (15), SY(29), ZZ (29)
      IF (KJ - 8)105, 100, 105
C.....LIMITS OF FOURIER SERIES
 100  LM = 15
      LN = 10
      GO TO 110
C.....LIMITS OF FOURIER SERIES
 105  LM = 29
      LN = 15
C.....HALF ANGLE (IN RADIANS)
 110  Q = .0087266466 * CEG
      IF(CEG .EQ. OLONG .AND. INIL .EQ. 0) GO TO 118
C.....LONGITUDE SINES
      DO 115 K = 1, 15
 115  SX(K)=SIN(Q*K)
      OLONG=CEG
 118  CONTINUE
C.....LONGITUDE SERIES
      DO 125 J = 1, LM
      R = 0.
      DO 120 K = 1, LN
 120  R = R + SX (K) * P (J, K, KJ)
 125  ZZ (J) = R + P (J, 16, KJ)
C.....ANGLE PLUS 90 DEGREES (IN RADIANS)
      Q = .017453292?2 * (XLA + 90.)
      IF(XLA .EQ. OLAT .AND. INIL .EQ. 0) GO TO 145
C.....LATITUDE SERIES
      DO 140 J=1,29
 140  SY(J)=SIN(Q*J)
      INIL=0
      OLAT=XLA
 145  CONTINUE
      R = 0.
      DO 130 K = 1, LM
 130  R = R + SY (K) * ZZ (K)
C.....FINAL FOURIER SERIES EVALUATION (NOTE LINEAR NORMALIZATION)
 135  ANOS = R + ABP(1,KJ)+ABP(2,KJ)* Q
      RETURN
      END
```

```
      SUBROUTINE GENFAM(Y2,IBLK,FREQ,Z,FA,DU,DL,DMS,DUS,DLS)
C
C     GENFAM CALCULATES THE FREQUENCY DEPENDENCE OF THE ATMOSPHERIC
C     NOISE AND GETS DECILES AND PREDICTION ERRORS FROM TABLES
C
      COMMON / TWO / F2D(16,6,6), DUD(5,12,5),FAM(14,12),
     A  SYS(9,16,6), PERR(9,4,6), P(29,16,8),ABP(2,9)
      DIMENSION V(5)
      IF(F2D(1,1,1) ) 90,90,95
C.....NO IONOSPHERIC LONG TERM DATA BASE FILE (SET IN SUBROUTINE GENOIS)
   90 FA = 0.0
      DU=9.
      DL=7.
      DUS=1.5
      DLS=1.5
      DMS=3.
      RETURN
   95 CONTINUE
      IBK=IBLK
C.....CHECK IF LATITUDE IS NORTH OR SOUTH
      IF (Y2)100, 105, 105
  100 IBK = IBK + 6
  105 U1 = - .75
      X = .43429 * ALOG (FREQ)
      U = (8. * 2. * X - 11.) / 4.
      KOP = 1
  110 PZ = U1 * FAM (1, IBK) + FAM (2, IBK)
      PX = U1 * FAM (8, IBK) + FAM (9, IBK)
      DO 115 I = 3, 7
      PZ = U1 * PZ + FAM (I, IBK)
  115 PX = U1 * PX + FAM (I + 7, IBK)
      IF(KOP-1) 120,120,125
  120 CZ = Z * PZ + PX
      CZ = Z + Z - CZ
      U1 = U
      KOP = 2
      GO TO 110
  125 FA = CZ * PZ + PX
      DO 145 I = 1, 5
      Y = DUD (1, IBK, I)
      DO 140 J = 2, 5
      IF (J - 5)140, 130, 140
  130 IF (X - 1.)140, 140, 135
  135 X = 1.
  140 Y = Y * X + DUD (J, IBK, I)
  145 V (I) = Y
      DU = V (1)
      DL = V (2)
      DUS = V (3)
      DLS = V (4)
      DMS = V (5)
      RETURN
      END
```

```
      SUBROUTINE GENOIS
C
C     THIS ROUTINE COMPUTES THE COMBINED NOISE DISTRIBUTION
C
      COMMON / DON / ALATD, AMIN, AMIND, DLONG, DMP, ERTR,
     1  PMP, PWR, RLAT, RLATD, RLONG, RLONGD, RSN, SIGTR,
     2 TLAT, TLATD, TLONG, TLONGD, FLUX, SSN, ATMNO, D90R, D50R,
     3 D10R, D90S, D50S, D10S
      COMMON/FILES/ LUO,LUI,LU25,LU26
      COMMON/ANOIS/ATNU,ATNY,CC,TM,XEFF,RCNSE,DU,DL,SIGM,SIGU,SIGL,KJ,JK
      COMMON /TON /ADJ, ADS, ATMO, GNOS, GOT, PWRDB, ZCNSE, REL, SL, SLS
     1, SPR, SU, SUS, TIMER, XADJN, ZEFF, XNOISE, XTLOS, ZNOISE, NF
      COMMON/FRQ/FREL(29),FREQ,JMODE
      COMMON / ION / IANT(3,2), NTR(2), IEA, IFOB, IFQE, IGRAPH, IHRE,
     A IHRO, IHRS, JO, LUFP, METHOD, MONPR, NDAY, NES, NOISE, NPAT,
     B NPSL, NRSP, NUMO
      COMMON / METSET /  ITRUN, ITOUT, JTRUN(40), JTOUT(40)
      COMMON/RON/RAT(5),CLCK(5),ABIY(5),ARTIC(5),SIGPAT(5),EPSPAT(5),
     A FI(3,5),YI(3,5),HI(3,5),FX(3,5),HPRIM(30,3),HTRUE(30,3),
     B FVERT(30,3),KFX,AFAC(30,3),HNOR(3),HTR(50),FNSQ(50)
      COMMON /RTANT /XETA, XSIG, XEPS, XND, XNL, XNH, TEX (4), ITANT, IP
     1 ANT, RETA, RSIG, REPS, RND, RNL, RNH, REX(4), TEFF, REFF, KASANT
      COMMON / TWO / F2D(16,6,6), DUD(5,12,5),FAM(14,12),
     A  SYS(9,16,6), PERR(9,4,6), P(29,16,8),ABP(2,9)
      COMMON / ZON / ABPS(7), CREL(7), EFF(7), FLOST(7), GRLOS(7),
     1HN (7), HP (7), PROB (7), RELY (7), RGAIN (7), SIGPOW (7), SN (7),
     2 SPRO (7), TGAIN (7), TIMED (7), TLOSS (7), B (7), FSLOS (7), ADV
     C (7),OBF(7),NMODE(7),NPROB,NREL,TLLOW(7),TLHGH(7)
      DIMENSION XNINT(4)
C.....MAN-MADE NOISE LEVELS AS GIVEN BY CCIR REPORT 258.
      DATA XNINT /76.8, 72.5, 67.2, 53.6/
      DATA DFAC,BFAC,CFAC/7.87384,30.99872,5.56765/
C
C     7.87384=SQRT(2*1.282**2*4.34294**2)
C
C     30.99872=(1.282**2)(4.34294**2)
C
C     5.56765=4.34294*1.282
C
C.....DATA IS FA VALUES AT 1 MHZ
C.....ATNU, ATNY ARE DB .GT. KTB FOR 1 MHZ
C.....ATNZ, ATNX ARE DB .GT. KTB FOR DESIRED FREQ,DUM
C.....ATNOS, GNOS, XNOIS ARE DB .GT. KTB FOR ALL CALCULATIONS
C.....AND ARE CONVERTED TO DBW(1 HZ BWDTH) AT END OF ROUTINE
C.....UPPER LIMIT IS 55 MHZ FOR NOISE
       DUME = AMIN1(FREQ,55.)
      MAN=NOISE
C  FREQUENCY DEPENDENCE ATMOSPHERIC NOISE
      IF(F2D(1,1,1)) 85, 90, 90
C.....NO IONOSPHERIC LONG TERM DATA BASE FILE
C.....FORCE MAN-MADE NOISE OR GALACTIC NOISE
   85 ATNOS = 0.
```

```
      DUA=9.
      DLA=7.
      SMA = 3.
      SUA = 1.5
      SLA = 1.5
      GO TO 95
   90 CONTINUE
C.....FREQUENCY DEPENDENCE
      CALL GENFAM(RLAT,KJ,DUME,ATNU,ATNZ,DU,DL,SIGM,SIGU,SIGL)
      CALL GENFAM(RLAT,JX,DUME,ATNY,ATNX,DX,DQ,SIGZ,SIGX,SIGSQ)
C.....BEGIN OF INTERPOLATION ON LOCAL TIME
      SLOP = ABS(CC-TM)/4.
      ATNOS = ATNZ + (ATNX - ATNZ) * SLOP
      DUA= DU +(DX-DU)*SLOP
      DLA= DL +(DQ-DL)*SLOP
        SMA= SIGM+ (SIGZ-SIGM)*SLOP
        SUA= SIGU +(SIGX-SIGU)*SLOP
        SLA= SIGL+(SIGSQ-SIGL)* SLOP
C
C     (DUA/DFAC)**2=(DUA/1.282)**2/(2*4.34294**2)
C                  =(DUA/SQRT(2*1.282**2*4.34294**2))**2
C                  =(DUA/7.87384)**2
C
   95 AU=EXP((DUA/DFAC)**2 + (ATNOS/4.34294))
      VU=AU*AU*(EXP(DUA*DUA/BFAC)-1.)
      AL=EXP((DLA/DFAC)**2 + (ATNOS/4.34294))
C
C     DLA*DLA/BFAC=(DLA/1.282)**2/(4.34294)**2
C                 =DLA**2/30.99872
C
      VL=AL*AL*(EXP(DLA*DLA/BFAC)-1.)
C  GALACTIC NOISE
      IF(FREQ - FI(3,KFX)) 100, 100, 105
C.....GALACTIC NOISE DOES NOT PENETRATE
  100 GNOS = 0.
      GO TO 110
  105 GNOS = 52. - 23. * ALOG10(FREQ)
  110 DUG=2.
      AT=EXP((DUG/DFAC)**2 + (GNOS/4.34294))
      AU=AU+AT
      VU=VU+AT*AT*(EXP(DUG*DUG/BFAC)-1.)
      DLG=2.
      AT=EXP((DLG/DFAC)**2 + (GNOS/4.34294))
      AL=AL+AT
      VL=VL+AT*AT*(EXP(DLG*DLG/BFAC)-1.)
      SMG = .5
      SUG = .2
      SLG = .2
C  MAN MADE  NOISE
       MAN=NOISE
      XNOIS = MAN
      MA = IABS(MAN)
      ZNOISE=XNOIS
      IF(MAN) 120, 114, 115
```

```
C.....INDICATES -164 ON USER INPUT
  114 MA = 4
      GO TO 120
C.....CONVERT 3 MHZ DB .LT. 1 WATT INPUT VALUE TO FA AT 1 MHZ
  115 XNOIS=204.0-XNOIS+13.22
C.....OBTAIN FA AT DESIRED FREQUENCY
      XNOIS = XNOIS - 27.7 * ALOG10(FREQ)
      GO TO 125
C....NEGATIVE ON USER INPUT INDICATES INDEX
  120 MA = MINO(4,MA)
      CONN=27.7
      IF(MA .EQ. 4) CONN=28.6
      XNOIS = XNINT(MA) - CONN * ALOG10(FREQ)
      ZNOISE = 204.0 - XNINT(MA) + 13.22
  125 DUM=9.7
      AT=EXP((DUM/DFAC)**2+(XNOIS/4.34294))
      AU=AU+AT
      VU=VU+AT*AT*(EXP(DUM*DUM/BFAC)-1.)
      DLM=6.
      AT=EXP((DLM/DFAC)**2+(XNOIS/4.34294))
      AL=AL+AT
      VL=VL+At*AT*(EXP(DLM*DLM/BFAC)-1.)
      SUM=1.5
      SMM=5.4
      SLM=1.5
C.....RECEIVER ANTENNA EFFICIENCY
      CALL GAIN(2,KASANT,0.0,FREQ,GDUM,REFF)
      XEFF = REFF
      ZEFF=XEFF
C.....SET ARRAY FOR ALL POSSIBLE MODES
      DO 196 IM=1,6
  196 EFF(IM) = XEFF
C.....NOW DETERMINATION OF NOISE LEVEL IS ITS-78(HFMUFES4)
C.....SWITCH TO DB .GT. WATT
      ATNOS=ATNOS-204.
      GNOS=GNOS-204.
      XNOIS=XNOIS-204.
      SIGTSQ=ALOG(1.+VU/(AU*AU))
      XRNSE= 4.34294*(ALOG(AU)-SIGTSQ/2.) -204.
C.....UPPER DECILE
C
C     CFAC=4.34294*1.282
C         =5.56765
C
      DU= CFAC*SQRT(SIGTSQ)
      SIGTSQ=ALOG(1.+VL/(AL*AL))
C.....LOWER DECILE
      DL= CFAC*SQRT(SIGTSQ)
      IF(ITRUN - 8) 205, 210, 205
  205 QPA = 10. ** ((ATNOS - XRNSE) * .1)
      QPG = 10.**((GNOS -XRNSE)*.1)
C.....PREDICTION ERRORS
C.....SIGM IS MEDIAN, SIGU IS UPPER AND SIGL IS LOWER
      QPM = 10.**((XNOIS-XRNSE)*.1)
```

```
      SIGM= SQRT((QPA*SMA)**2 +(QPG*SMG)**2 + QPM*SMM)**2)
C
C     0.23026=1.0/4.34294
C
      PV=QPA*EXP((DUA-DU)*.23026)
      SIGU= (PV*SUA)**2+((PV-QPA)*SMA)**2
      PV=QPG*EXP((DUG-DU)*.23026)
      SIGU=SIGU+(PV*SUG)**2+((PV-QPG)*SMG)**2
      PV=QPM*EXP((DUM-DU)*.23026)
      SIGU=SQRT(SIGU+(PV*SUM)**2+((PV-QPM)*SMM)**2)
      PV=QPA*EXP((DLA-DL)*.23026)
      SIGL= (PV*SLA)**2+((PV-QPA)*SMA)**2
      PV=QPG*EXP((DLG-DL)*.23026)
      SIGL=SIGL+(PV*SLG)**2+((PV-QPG)*SMG)**2
      PV=QPM*EXP((DLM-DL)*.23026)
      SIGL=SQRT(SIGL+(PV*SLM)**2+((PV-QPM)*SMM)**2)
C RCVR SITE NOISE = TOTAL NOISE + ANTENNA EFFICENCY (ADDED TO SIGNAL
C   WITH GAIN)
  210 RCNSE = XRNSE + XEFF
      ZCNSE=RCNSE
      ATMND=ATNOS
      XADJN=1.
      XNOISE=XNOIS
      ATMO=ATNOS
      RETURN
      END
```

VI. LISTING OF ANTENNA PATTERN GENERATION SUBPROGRAM MAKDAT.FOR

```
C     PROGRAM MAKDAT.FOR
C
C     THIS PROGRAM CREATES A RECEIVER AND TRANSMITTER ANTENNA
C     PATTERN FILE FOR INPUT TO IONCAP.
C     9 SEPT 1985
C
      DIMENSION XFQS(3),XFQE(3),YNH(3),YNL(3),YND(3),
     *      YETA(3),TEY(3,4),COND(3),DIEL(3),ARRAY(30,91),AEFF(30),
     *      TOAZ(3),AREFF(30)
      CHARACTER*6 LABANT(2,3)
C
      DATA NA/1/,JTSANT/1/,XFQS/1.,1.,1./,XFQE/30.,30.,30./,
     *  YNH/0.,0.,0./,YNL/0.,0.,0./,YND/0.,0.,0./,YETA/0.,0.,0./,
     *  TEY/12*0./,COND/.01,.01,.01/,DIEL/10.,10.,10./,
     *  TOAZ/0.,0.,0./,LABANT/6*'      '/
     *  AEFF/30*0./,AREFF/30*-4.8/
      DATA (ARRAY(1,I),I=1,91)/
     *     -20.0,-14.0,-11.0,-7.6,-5.4,-4.0,-3.2,-2.5,-1.8,-1.6,
     *     -1.3,-1.1,-.9,-.6,-.5,-.4,-.2,-.1,0,0,0,0,0,0,0,0,
     *     -.1,-.2,-.2,-.2,-.3,-.3,-.4,-.5,-.5,-.6,-.7,-.8,-.8,
     *     -.9,-.1,-1.1,-1.2,-1.4,-1.5,-1.6,-1.8,-1.9,-2.,-2.1,
     *     -2.3,-2.4,-2.6,-2.7,-2.9,-3.1,-3.2,-3.4,-3.6,-3.7,
     *     -3.9,-4.2,-4.4,-4.7,-5.0,-5.4,-5.7,-6.0,-6.4,-6.7,
     *     -7.1,-7.5,-7.9,-8.4,-8.8,-9.3,-9.8,-10.4,-10.9,-11.4,
     *     -12.,-12.6,-13.2,-13.9,-14.6,-15.4,-16.2,-17.2,-18.2,
     *     -19.6,-21.9/
C
      OPEN (UNIT=2,FILE='TAPE26',STATUS='UNKNOWN',FORM='UNFORMATTED')
C
C     RECEIVER ANTENNA PATTERNS
C
      DO 20 I=2,30
        DO 30 J=1,91
           ARRAY(I,J) = ARRAY(1,J)
 30     CONTINUE
 20   CONTINUE
      LABANT(1,1)='SWWHIP'
C
      WRITE (2) NA,JTSANT,(XFQS(ITY),XFQE(ITY),LABANT(1,ITY),
     *  LABANT(2,ITY),YNH(ITY),YNL(ITY),YND(ITY),TOAZ(ITY),
     *  (TEY(ITY,K),K=1,4),COND(ITY),DIEL(ITY),ITY=1,3),
     *  ((ARRAY(I,J),I=1,30),J=1,91),(AREFF(I),I=1,30)
C
C     TRANSMITTER ANTENNA PATTERNS
C
      ARRAY(1,1) = -26.
      ARRAY(1,2) = 5.
      ARRAY(1,3) = 10.
      ARRAY(1,4) = 15.
      ARRAY(1,5) = 17.
      LABANT(1,1) = 'CONS17'
C
      DO 40 I=6,91
        ARRAY(1,I) = 17.
  40  CONTINUE
      DO 50 I=2,30
        DO 60 J=1,91
        ARRAY(I,J)=ARRAY(1,J)
 60     CONTINUE
 50   CONTINUE
```

```
C
      WRITE (2) NA,JTSANT,(XFQS(ITY),XFQE(ITY),LABANT(1,ITY),
     *  LABANT(2,ITY),YNH(ITY),YNL(ITY),YND(ITY),TOAZ(ITY),
     *  (TEY(ITY,K),K=1,4),COND(ITY),DIEL(ITY),ITY=1,3),
     *  ((ARRAY(I,J),I=1,30),J=1,91),(AEFF(I),I=1,30)
      CLOSE (2)
      END
```

VII. LISTING OF SOURCE CODE MODICATIONS

AERIAL.FOR

```
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]AERIAL.FOR;1
     1          SUBROUTINE AERIAL
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]AERIAL.FOR;1
     1    Czzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzz
     2          SUBROUTINE AERIAL
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]AERIAL.FOR;1
    11          COMMON / METSET / VERSN, ITRUN, ITOUT, JTRUN(40), JTOUT(40)
    12          COMMON / ANTTYP / IANT1(2,13), IANT78(2,18), LABANT(2,3,2)
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]AERIAL.FOR;1
    12          COMMON / METSET / VERSN, ITRUN, ITOUT, JTRUN(40), JTOUT(40), LSEAS
    13          COMMON / ANTTYP / IANT1(2,13), IANT78(2,18), LABANT(2,3,2)
************
                    Number of difference sections found: 2
                    Number of difference records  found: 2
```

ALOSFV.FOR

```
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]ALOSFV.FOR;1
    12          COMMON /RON /CLAT (5), CLONG (5), GLAT (5), RD (5), FI (3, 5), YI
    13         1(3, 5), HI (3, 5), HPRIM (30, 3), HTRUE (30, 3), FVERT (30, 3), KM
    14         2, KFX, AFAC (30, 3), HNOR (3)
    15          COMMON/MUFS/EMUF(24),F1MUF(24),F2MUF(24),ESMUF(24),ALLMUF(24)
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]ALOSFV.FOR;1
    12          COMMON /RON /CLAT(5), CLONG(5), GLAT(5), RD(5), FI(3,5), YI(3,5),
    13         1HI(3,5), HPRIM(30,5), HTRUE(30,5), FVERT(30,5),KM,KFX, AFAC(30,5),
    14         2HTR(50), FNSQ(50)
    15          COMMON/MUFS/EMUF(24),F1MUF(24),F2MUF(24),ESMUF(24),ALLMUF(24)
************
                    Number of difference sections found: 1
                    Number of difference records  found: 3
```

ANOIS1.FOR

```
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]ANOIS1.FOR;1
     8          COMMON/ANOIS/ATNU,ATNY,CC,TM,XEFF,RCNSE,DU,DL,SIGM,SIGU,SIGL,KJ,JK
     9          COMMON /CON /D2R, DCL, GAMA, PI, PI2, PIO2, R2D, RZ, VOFL
    10          COMMON /DON /ALATD, AMIN, AMIND, BTR, BTRD, DLONG, DMP, ERTR, GCD,
    11         1 GCDKM, PMP, PWR, RLAT, RLATD, RLONG, RLONGD, RSN, SIGTR, TLAT, TL
    12         2ATD, TLONG, TLONGD, BRTD, FLUX, SSN, ATMNO
    13          COMMON / TIME / IT, GMT, UTIME(24), GMTR, XLMT(24)
    14          COMMON / TWO / F2D(16,6,6), P(29,16,8), ABP(2,8), DUD(5,12,5),
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]ANOIS1.FOR;1
     8          COMMON/ANOIS/ATNU,ATNY,CC,TM,RCNSE,DU,DL,SIGM,SIGU,SIGL,KJ,JK
     9          COMMON /CON /D2R, DCL, GAMA, PI, PI2, PIO2, R2D, RZ, VOFL
    10          COMMON /DON /ALATD, AMIN, AMIND, BTR, BTRD, DLONG, DMP, ERTR, GCD,
    11         1 GCDKM, PMP, PWR, RLAT, RLATD, RLONG, RLONGD, RSN, SIGTR, TLAT,
    12         2 TLATD,TLONG,TLONGD,BRTD,FLUX,SSN,D90R,D50R,D10R,D90S,D50S,D10S
    13          COMMON / TIME / IT, GMT, UTIME(24), GMTR, XLMT(24), ITIM, JTX
    14          COMMON / TWO / F2D(16,6,6), P(29,16,8), ABP(2,8), DUD(5,12,5),
************
                    Number of difference sections found: 1
                    Number of difference records  found: 6
```

BABS.FOR

```
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]BABS.FOR;1
     6          COMMON/FRQ/FREL(29),FREQ
     7          COMMON/CON/D2R,DCL,GAMA,PI,PI2,PIO2,R2D,RZ,VOFL
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]BABS.FOR;1
     6          COMMON / FRQ / FREL(29), FREQ, JMODE
     7          COMMON/CON/D2R,DCL,GAMA,PI,PI2,PIO2,R2D,RZ,VOFL
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]BABS.FOR;1
    10          COMMON/RON/CLAT(5),CLONG(5),GLAT(5),RD(5),FI(3,5),YI(3,5),HI(3,5)
    11          COMMON/SIGD/DSL,ASM,DSM,AGLAT,DSLF,ASMF,DSUF,ACAV,FEAV,AFE,BFE,HNU
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]BABS.FOR;1
    10          COMMON /RON /CLAT(5), CLONG(5), GLAT(5), RD(5), FI(3,5), YI(3,5),
    11         1HI(3,5), HPRIM(30,5), HTRUE(30,5), FVERT(30,5),KM,KFX, AFAC(30,5),
    12         2HTR(50), FNSQ(50)
    13          COMMON/SIGD/DSL,ASM,DSM,AGLAT,DSLF,ASMF,DSUF,ACAV,FEAV,AFE,BFE,HNU
************
                    Number of difference sections found: 2
                    Number of difference records  found: 4
```

BEARNG.FOR

```
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]BEARNG.FOR;1
     5          COMMON / DON / ALATD, AMIN, AMIND, BTR, BTRD, DLONG, DMP, ERTR,
     6         1 GCD, GCDKM, PMP, PWR, RLAT, RLATD, RLONG, RLONGD, RSN, SIGTR,
     7         2 TLAT, TLATD, TLONG, TLONGD, BRTD, FLUX, SSN, ATMNO
     8          COMMON / RTANT / XETA, XSIG, XEPS, XND, XNL, XNH, TEX(4), ITANT,
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]BEARNG.FOR;1
     5          COMMON /DON /ALATD, AMIN, AMIND, BTR, BTRD, DLONG, DMP, ERTR, GCD,
     6         1 GCDKM, PMP, PWR, RLAT, RLATD, RLONG, RLONGD, RSN, SIGTR, TLAT,
     7         2 TLATD,TLONG,TLONGD,BRTD,FLUX,SSN,D90R,D50R,D10R,D90S,D50S,D10S
     8          COMMON / RTANT / XETA, XSIG, XEPS, XND, XNL, XNH, TEX(4), ITANT,
************
                    Number of difference sections found: 1
                    Number of difference records  found: 3
```

BENDY.FOR

```
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]BENDY.FOR;1
     5          COMMON/RON/CLAT(5),CLONG(5),GLAT(5),RD(5),FI(3,5),YI(3,5),HI(3,5)
     6          X =  F/ FI(I,K)
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]BENDY.FOR;1
     5          COMMON /RON /CLAT(5), CLONG(5), GLAT(5), RD(5), FI(3,5), YI(3,5),
     6         1HI(3,5), HPRIM(30,5), HTRUE(30,5), FVERT(30,5),KM,KFX, AFAC(30,5),
     7         2HTR(50), FNSQ(50)
     8          X =  F/ FI(I,K)
************
                    Number of difference sections found: 1
                    Number of difference records  found: 3
```

```
**********
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]BLKDAT.FOR;1
   16          COMMON/ANOIS/ATNU,ATNY,CC,TM,ZEFF,ZCNSE,DU,DL,SIGM,SXGU,SXGL,KJ,JK
   17    C CONSTANTS,SET BELOW.
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]BLKDAT.FOR;1
   16          COMMON/ANOIS/ATNU,ATNY,CC,TM,RCNSE,DU,DL,SIGM,SxGU,SxGL,KJ,JK
   17    C CONSTANTS,SET BELOW.
**********
**********
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]BLKDAT.FOR;1
   22         C NUMNAM, NUPROC, MAXMET
   23    C WEIGHTS AND ABSCISSCAE FOR 40 POINT GUASSIAN SET BELOW.
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]BLKDAT.FOR;1
   22         C NUMNAM, NUPROC, MAXMET, mspec, m100
   23    C WEIGHTS AND ABSCISSCAE FOR 40 POINT GUASSIAN SET BELOW.
**********
**********
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]BLKDAT.FOR;1
   27         1 GCDKM, PMP, PWR, RLAT, RLATD, RLONG, RLONGD, RSN, SIGTR, TLAT, TL
   28         2ATD,TLONG,TLONGD,BRTD,FLUX,SSN,ATMNO,D90R,D50R,D10R,D90S,D50S,D10S
   29    C SPORADIC E LAYER, SEE SUBR. ESIND.
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]BLKDAT.FOR;1
   27         1 GCDKM, PMP, PWR, RLAT, RLATD, RLONG, RLONGD, RSN, SIGTR, TLAT,
   28         2 TLATD,TLONG,TLONGD,BRTD,FLUX,SSN,D90R,D50R,D10R,D90S,D50S,D10S
   29          COMMON / OUTLAB / LABEL(11), LAYTYP(5), IEAST, INORTH, ISOUTH,
   30         A IWEST, LABLI, LABLJ, LABLK
   31    C SPORADIC E LAYER, SEE SUBR. ESIND.
**********
**********
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]BLKDAT.FOR;1
   39    C GEOGRAPHIC VARIABLES AT SAMPLE AREAS,SEE GEOM,TIMVAR,MAGVAR AND LUFFY.
   40          COMMON /GEOG /GYZ (5), RAT (5), GMDIP (5), CLCK (5), ABIY (5), ART
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]BLKDAT.FOR;1
   41    C GEOGRAPHIC VARIABLES AT SAMPLE AREAS,SEE GEOM,TIMVAR,MAGVAR AND
LUFFY.
   42          COMMON /GEOG /GYZ (5), RAT (5), GMDIP (5), CLCK (5), ABIY (5), ART
**********
**********
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]BLKDAT.FOR;1
   48    C  LONG PATH PARAMETERS,SEE SUBRS LNGLUF AND LNGPAT.
   49          COMMON/LPATH/ GCDLNG,TGML(45),RGML(45),DELOPT,GMIN,YMIN,LTGM,LRGM
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]BLKDAT.FOR;1
   50    C  LONG PATH PARAMETERS,SEE SUBR LNGPAT.
   51          COMMON/LPATH/ GCDLNG,TGML(45),RGML(45),DELOPT,GMIN,YMIN,LTGM,LRGM
**********
**********
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]BLKDAT.FOR;1
   67          COMMON / OUTLAB / LABEL(11), LAYTYP(5), IEAST, INORTH, ISOUTH,
   68         A IWEST, LABLI, LABLJ, LABLK
   69    C  LAT AND LONG DIRECTION INDICATORS, LINE NUMBER AND MAXIMUM LINES
```

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******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]BLKDAT.FOR;1
   69    C  LAT AND LONG DIRECTION INDICATORS, LINE NUMBER AND MAXIMUM LINES
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]BLKDAT.FOR;1
   75          COMMON/RAYS/ANG(40),IFOB(40,30,3),NANG
   76    C REFLECTRICIES AT FREQ, SEE SUBR. FINDF.
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]BLKDAT.FOR;1
   75          COMMON/RAYS/ANG(40),IFOB(40,30,5),NANG
   76    C REFLECTRICIES AT FREQ, SEE SUBR. FINDF.
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]BLKDAT.FOR;1
   80         C ,DELPEN(3,3)
   81    C GEOGRAPHIC AND IONSPHERIC DATA AT SAMPLE AREAS,SEE GEOM AND GENION.
   82          COMMON /RON /CLAT (5), CLONG (5), GLAT (5), RD (5), FI (3, 5), YI
   83         1(3, 5), HI (3, 5), HPRIM (30, 3), HTRUE (30, 3), FVERT (30, 3), KM
   84         B , KFX, AFAC(30,3), HNOR(3), FX(3,5), HTR(50), FNSQ(50)
   85    C ANTENNA DATA(INPUT), SEE AERIAL AND HFMUFES.
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]BLKDAT.FOR;1
   80         C ,DELPEN(3,5)
   81    C GEOGRAPHIC AND IONSPHERIC DATA AT SAMPLE AREAS,SEE GEOM AND GENION.
   82          COMMON /RON /CLAT(5), CLONG(5), GLAT(5), RD(5), FI(3,5), YI(3,5),
   83         1HI(3,5), HPRIM(30,5), HTRUE(30,5), FVERT(30,5),KM,KFX, AFAC(30,5),
   84         2HTR(50), FNSQ(50)
   85    C ANTENNA DATA(INPUT), SEE AERIAL AND HFMUFES.
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]BLKDAT.FOR;1
   94         A DBLOSL(13), DBLOSU(13), DBU(13), DELAY(13), NDBW(13), NHP(13),
   95         B NYNOIS(13), PROBMP(13), RELIAB(13), SNDB(13), SNPR(13),
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]BLKDAT.FOR;1
   94         A DBLOSL(13), DBLOSU(13), DBU(13), DELAY(13), DBW(13), NHP(13),
   95         B NYNOIS(13), PROBMP(13), RELIAB(13), SNDB(13), SNPR(13),
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]BLKDAT.FOR;1
  102          COMMON /TON /ADJ, ADS, ATMO, GNOS, GOT, PWRDB, RCNSE, REL, SL, SLS
  103         1, SPR, SU, SUS, TIMER, XADJN, XEFF, XNOISE, XTLOS, ZNOISE, NF
  104    C  LOSSES FOR MODES.  SEE SUBR. REGMOD.
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]BLKDAT.FOR;1
  102          COMMON /TON /ADJ, ADS, GNOS, GOT, PWRDB, REL, SL, SLS
  103         1, SPR, SU, SUS, XNOISE, ZNOISE, NF
  104    C  LOSSES FOR MODES.  SEE SUBR. REGMOD.
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]BLKDAT.FOR;1
  108          COMMON / ZON / ABPS(7), CREL(7), EFF(7), FLDST(7), GRLOS(7),
  109         1HN (7), HP (7), PROB (7), RELY (7), RGAIN (7), SIGPOW (7), SN (7),
  110         2 SPRO (7), TGAIN (7), TIMED (7), TLOSS (7), B (7), FSLOS (7), ADV
  111         C (7),OBF(7),NMODE(7),NPROB,NREL,TLLOW(7),TLHGH(7)
  112    C NUMERICAL MAP COEFICENTS, SEE REDMAP.
******
```

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File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]BLKDAT.FOR;1
  108          COMMON / allMODE /ABPS(20),CREL(20),FLDST(20),HN(20),HP(20),
  109         1PROB(20),RELY(20),RGAIN(20),SIGPOW(20),SN(20),
  110         2SPRO(20),TGAIN(20),TIMED(20),TLOSS(20),B(20),FSLOS(20),
  111         CNMODE(20),TLLOW(20),TLHGH(20),EFF(20),NREL,NMMOD
  112    C NUMERICAL MAP COEFICENTS, SEE REDMAP.
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]BLKDAT.FOR;1
  190          DATA ADJ/1./,ADS/1./,ATMO/1./,GNOS/1./,GOT/1./,PWRDB/1./
  191          DATA RCNSE/-204./,REL/.01/,SL/1./,SLS/1./,SPR/.01/,SU /1./,SUS/1./
  192          DATA TIMER/1./,XADJN/1./,XEFF/1./,XNOISE/1./,XTLOS/1./
  193          DATA ZNOISE/-204./, NF/1/, FLUX/1./, ATMNO/1./, DMP/0.85/
  194          DATA ERTR/1./, PMP/10./, PWR/1./, RSN/1./, SIGTR/1./
  195          DATA ATNU/-204./,ATNY/-204./,CC/1./,TM/1./,ZEFF/1./,ZCNSE/-204./
  196          DATA DU/9./,DL/4./,SIGM/1.5/,SXGL/1./,SXGU/1./,KJ/1/,JK/1/
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]BLKDAT.FOR;1
  190          DATA ADJ/1./,ADS/1./,GNOS/1./,GOT/1./,PWRDB/1./
  191          DATA RCNSE/-204./,REL/.01/,SL/1./,SLS/1./,SPR/.01/,SU /1./,SUS/1./
  192          DATA XNOISE/1./
  193          DATA ZNOISE/-204./, NF/1/, FLUX/1./, DMP/0.85/
  194          DATA ERTR/1./, PMP/10./, PWR/1./, RSN/1./, SIGTR/1./
  195          DATA ATNU/-204./,ATNY/-204./,CC/1./,TM/1./
  196          DATA DU/9./,DL/4./,SIGM/1.5/,SXGL/1./,SXGU/1./,KJ/1/,JK/1/
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]BLKDAT.FOR;1
  213         B NUMNAM/31/, MAXNAM/100/, MAXMET/30/, IRED/1/
  214          DATA NPROB/1/, NREL/1/, IEDP/-1/, TLONG/.68965/
  215          DATA AMIND/3./, AMIN/.05236/
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]BLKDAT.FOR;1
  213         B NUMNAM/31/, MAXNAM/100/, MAXMET/30/, IRED/1/, mspec/0/,m100/75/
  214          DATA NMMOD/1/, NREL/1/, IEDP/-1/, TLONG/.68965/
  215          DATA AMIND/3./, AMIN/.05236/
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]BLKDAT.FOR;1
  242          DATA VERSN /85.04/
  243    C
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]BLKDAT.FOR;1
  242          DATA VERSN /88.01/
  243    C
************
                    Number of difference sections found: 14
                    Number of difference records  found: 32
```

CALVHF.FOR

```
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]CALVHF.FOR;1
   14          COMMON/TIME/IT,GMT,UTIME(24)
   15          COMMON/MUFS/EMUF(24),F1MUF(24),F2MUF(24),ESMUF(24),ALLMUF(24),FOT
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]CALVHF.FOR;1
   14          COMMON / TIME / IT, GMT, UTIME(24), GMTR, XLMT(24), ITIM, JTX
   15          COMMON/MUFS/EMUF(24),F1MUF(24),F2MUF(24),ESMUF(24),ALLMUF(24),FOT
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]CALVHF.FOR;1
   20         A DBLOSL(13), DBLOSU(13), DBU(13), DELAY(13), NDBW(13), NHP(13),
   21         B NYNOIS(13), PROBMP(13), RELIAB(13), SNDB(13), SNPR(13),
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]CALVHF.FOR;1
   20         A DBLOSL(13), DBLOSU(13), DBU(13), DELAY(13), DBW(13), NHP(13),
   21         B NYNOIS(13), PROBMP(13), RELIAB(13), SNDB(13), SNPR(13),
************
                    Number of difference sections found: 2
                    Number of difference records  found: 2
```

CISI.FOR

```
                    Number of difference sections found: 0
                    Number of difference records  found: 0
```

CNGTIM.FOR

```
                    Number of difference sections found: 0
                    Number of difference records  found: 0
```

CONVH.FOR

```
                    Number of difference sections found: 0
                    Number of difference records  found: 0
```

CURMUF.FOR

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************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]CURMUF.FOR;1
   14          COMMON/RON/CLAT(5),CLONG(5),GLAT(5),RD(5),FI(3,5),YI(3,5),HI(3,5)
   15         A,HPRIM(30,3),HTRUE(30,3),FVERT(30,3),KM,KFX,AFAC(30,3),HNOR(3)
   16         B ,FX(3,5),HTR(50),FNSQ(50)
   17          COMMON/DON/ALATD,AMIN,AMIND,BTR,BTRD,DLONG,DMP,ERTR,GCD,GCDKM,PMP
   18         A ,PWR,RLAT,RLATD,RLONG,RLONGD,RSN,SIGTR,TLAT,TLATD,TLONG,TLONGD
   19         B ,BRTD,FLUX,SSN,ATMNO
   20          COMMON/TIME/IT,GMT,UTIME(24),GMTR,XLMT(24)
   21          COMMON / CON / D2R, DCL, GAMA, PI, PI2, PIO2, R2D, RZ, VOFL
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]CURMUF.FOR;1
   14          COMMON /RON /CLAT(5), CLONG(5), GLAT(5), RD(5), FI(3,5), YI(3,5),
   15         1HI(3,5), HPRIM(30,5), HTRUE(30,5), FVERT(30,5),KM,KFX, AFAC(30,5),
   16         2HTR(50), FNSQ(50)
   17          COMMON /DON /ALATD, AMIN, AMIND, BTR, BTRD, DLONG, DMP, ERTR, GCD,
   18         1 GCDKM, PMP, PWR, RLAT, RLATD, RLONG, RLONGD, RSN, SIGTR, TLAT,
   19         2 TLATD,TLONG,TLONGD,BRTD,FLUX,SSN,D90R,D50R,D10R,D90S,D50S,D10S
   20          COMMON / TIME / IT, GMT, UTIME(24), GMTR, XLMT(24), ITIM, JTX
   21          COMMON / CON / D2R, DCL, GAMA, PI, PI2, PIO2, R2D, RZ, VOFL
```

CURMUF.FOR (cont'd.)

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************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]CURMUF.FOR;1
   63          DO 148 K=1,KFX
   64          FX(1,K) = FXE
   65          FX(2,K) = FX1
   66          FX(3,K) = FX2
   67      148 CONTINUE
   68    C
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]CURMUF.FOR;1
   63    C
************
                    Number of difference sections found: 2
                    Number of difference records  found: 12
```

DECRED.FOR

```
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]DECRED.FOR;1
   12         C NUMNAM, NUPROC, MAXMET
   13          COMMON /DON /ALATD, AMIN, AMIND, BTR, BTRD, DLONG, DMP, ERTR, GCD,
   14         1 GCDKM, PMP, PWR, RLAT, RLATD, RLONG, RLONGD, RSN, SIGTR, TLAT, TL
   15         2ATD, TLONG, TLONGD, BRTD, FLUX, SSN, ATMNO
   16          COMMON /ES /FS (3, 5), HS (5)
   17          COMMON /FRQ /FREL (29), FREQ
   18          COMMON /GEOG /GYZ (5), RAT (5), GMDIP (5), CLCK (5), ABIY (5), ART
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]DECRED.FOR;1
   12         C NUMNAM, NUPROC, MAXMET, mspec, m100
   13          COMMON /DON /ALATD, AMIN, AMIND, BTR, BTRD, DLONG, DMP, ERTR, GCD,
   14         1 GCDKM, PMP, PWR, RLAT, RLATD, RLONG, RLONGD, RSN, SIGTR, TLAT,
   15         2 TLATD,TLONG,TLONGD,BRTD,FLUX,SSN,D90R,D50R,D10R,D90S,D50S,D10S
   16          COMMON /ES /FS (3, 5), HS (5)
   17          COMMON / FRQ / FREL(29), FREQ, JMODE
   18          COMMON /GEOG /GYZ (5), RAT (5), GMDIP (5), CLCK (5), ABIY (5), ART
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]DECRED.FOR;1
   24          COMMON / METSET / VERSN, ITRUN, ITOUT, JTRUN(40), JTOUT(40)
   25          COMMON / MFAC / F2M3(5),HPF2(5),ZENANG(5),ZENMAX(5),IEDP,FSECV(3)
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]DECRED.FOR;1
   24          COMMON / METSET / VERSN, ITRUN, ITOUT, JTRUN(40), JTOUT(40), LSEAS
   25          COMMON / MFAC / F2M3(5),HPF2(5),ZENANG(5),ZENMAX(5),IEDP,FSECV(3)
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]DECRED.FOR;1
   33          COMMON / RAYS / ANG(40), IFOB(40,30,3), NANG
   34          COMMON /REFLX /DELFX (45, 3), HPFLX (45, 3), HTFLX (45, 3), GDFLX
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]DECRED.FOR;1
   33          COMMON / RAYS / ANG(40), IFOB(40,30,5), NANG
   34          COMMON /REFLX /DELFX (45, 3), HPFLX (45, 3), HTFLX (45, 3), GDFLX
```

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************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]DECRED.FOR;1
   37         3 DELPEN(3,3)
   38          COMMON /RON /CLAT (5), CLONG (5), GLAT (5), RD (5), FI (3, 5), YI
   39         1(3, 5), HI (3, 5), HPRIM (30, 3), HTRUE (30, 3), FVERT (30, 3), KM
   40         B , KFX, AFAC(30,3), HNOR(3), FX(3,5), HTR(50), FNSQ(50)
   41          COMMON /RTANT /XETA, XSIG, XEPS, XND, XNL, XNH, TEX (4), ITANT, IR
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]DECRED.FOR;1
   37         3 DELPEN(3,5)
   38          COMMON /RON /CLAT(5), CLONG(5), GLAT(5), RD(5), FI(3,5), YI(3,5),
   39         1HI(3,5), HPRIM(30,5), HTRUE(30,5), FVERT(30,5),KM,KFX, AFAC(30,5),
   40         2HTR(50), FNSQ(50)
   41          COMMON /RTANT /XETA, XSIG, XEPS, XND, XNL, XNH, TEX (4), ITANT, IR
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]DECRED.FOR;1
   44          COMMON / TIME / IT, GMT, UTIME(24), GMTR, XLMT(24), ITIM
   45          COMMON /TON /ADJ, ADS, ATMO, GNOS, GOT, PWRDB, RCNSE, REL, SL, SLS
   46         1, SPR, SU, SUS, TIMER, XADJN, XEFF, XNOISE, XTLOS, ZNOISE, NF
   47          COMMON /ZON /ABPS (7), CREL (7), EFF (7), FLDST(7), GRLOS(7),
   48         1HN (7), HP (7), PROB (7), RELY (7), RGAIN (7), SIGPOW (7), SN (7),
   49         2 SPRO (7), TGAIN (7), TIMED (7), TLOSS (7), B (7), FSLOS (7)
   50          COMMON / FILES / LUI, LUO, LU2, LU5, LU6, LU15, LU16, LU20, LU25,
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]DECRED.FOR;1
   44          COMMON / TIME / IT, GMT, UTIME(24), GMTR, XLMT(24), ITIM, JTX
   45          COMMON /TON /ADJ, ADS, GNOS, GOT, PWRDB, REL, SL, SLS
   46         1, SPR, SU, SUS, XNOISE, ZNOISE, NF
   47          COMMON / ZON / ABPS(7), CREL(7), EFF(7), FLDST(7), GRLOS(7),
   48         1 HN(7), HP(7), PROB(7), RELY(7), RGAIN(7), SIGPOW(7), SN(7),
   49         2 SPRO(7), TGAIN(7), TIMED(7), TLOSS(7), B(7), FSLOS(7), ADV(7),
   50         3 OBF(7),NMODE(7),TLLOW(7),TLHGH(7)
   51          COMMON / FILES / LUI, LUO, LU2, LU5, LU6, LU15, LU16, LU20, LU25,
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]DECRED.FOR;1
  158      115 READ(LU61,1500) METHOD, NPAGO
  159    C.....TERMINATE EXECUTION IF METHOD .LE. 0 OR .GT. MAXIMUM METHOD
  160    C.....HOWEVER, A "QUIT" CARD IS REQUIRED AS THE LAST CONTROL CARD
  161          IF(METHOD) 120, 120, 122
  162      122 IF(METHOD - MAXMET) 125, 125, 120
  163      120 ITRUN = 0
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]DECRED.FOR;1
  159      115 READ(LU61,1500) METHOD, NPAGO, mspec
  160    C.....TERMINATE EXECUTION IF METHOD .LE. 0 OR .GT. MAXIMUM METHOD
  161    C.....HOWEVER, A "QUIT" CARD IS REQUIRED AS THE LAST CONTROL CARD
  162          IF(METHOD - MAXMET) 125, 125, 120
  163      120 ITRUN = 0
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]DECRED.FOR;1
  241          IF(SUNSP(ISSNP1)) 217, 218, 217
  242      217 MORES = 1
```

DECRED.FOR (cont'd.)

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******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]DECRED.FOR;1
  241          IF(SUNSP(I SSNP1)) 217, 218, 217
  242     217 MORES = 1
************
```

Number of difference sections found: 7
Number of difference records found: 25

DIREAD.FOR

```
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]DIREAD.FOR;1
    9    1500 FORMAT('1',80('X'),/,' N O T E - THE FREEFORM INPUT PROCESSOR ',
   10        A 'IS NOT DEVELOPED',/,1X,80('X'),/,' INPUT MUST CONSIST OF ',
   11        B 'FORMATTED CARD IMAGES')
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]DIREAD.FOR;1
    9    1500 FORMAT(1H1,80('X'),/,' N O T E -THE FREEFORM INPUT PROCESS',
   10        A 'OR IS NOT DEVELOPED',/,1X,80('X'),/,' INPUT MUST CONSIST OF ',
   11        B 'FORMATTED CARD IMAGES')
************
```

Number of difference sections found: 1
Number of difference records found: 2

EF1VAR.FOR

```
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]EF1VAR.FOR;1
   11        1 GCDKM, PMP, PWR, RLAT, RLATD, RLONG, RLONGD, RSN, SIGTR, TLAT, TL
   12        2ATD, TLONG, TLONGD, BRTD, FLUX, SSN, ATMNO
   13         COMMON/TIME/IT,GMT,UTIME(24)
   14         COMMON /A11 /GAMMA (6)
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]EF1VAR.FOR;1
   11        1 GCDKM, PMP, PWR, RLAT, RLATD, RLONG, RLONGD, RSN, SIGTR, TLAT,
   12        2 TLATD,TLONG,TLONGD,BRTD,FLUX,SSN,D90R,D50R,D10R,D90S,D50S,D10S
   13         COMMON / TIME / IT, GMT, UTIME(24), GMTR, XLMT(24), ITIM, JTX
   14         COMMON /A11 /GAMMA (6)
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]EF1VAR.FOR;1
   18         COMMON /RON /CLAT (5), CLONG (5), GLAT (5), RD (5), FI (3, 5), YI
   19        1(3, 5), HI (3, 5), HPRIM (30, 3), HTRUE (30, 3), FVERT (30, 3), KM
   20        2, KFX
   21         COMMON /GEOG /GY (5), RAT (5), GMDIP (5)
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]EF1VAR.FOR;1
   18         COMMON /RON /CLAT(5), CLONG(5), GLAT(5), RD(5), FI(3,5), YI(3,5),
   19        1HI(3,5), HPRIM(30,5), HTRUE(30,5), FVERT(30,5),KM,KFX, AFAC(30,5),
   20        2HTR(50), FNSQ(50)
   21         COMMON /GEOG /GY (5), RAT (5), GMDIP (5)
************
```

Number of difference sections found: 2
Number of difference records found: 6

ESIND.FOR

```
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]ESIND.FOR;1
   12          COMMON /RON /CLAT (5), CLONG (5), GLAT (5), RD (5), FI (3, 5), YI
   13         1(3, 5), HI (3, 5), HPRIM (30, 3), HTRUE (30, 3), FVERT (30, 3), KM
   14         2, KFX
   15          IF (KM .LT. 1) GO TO 105
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]ESIND.FOR;1
   12          COMMON /RON /CLAT(5), CLONG(5), GLAT(5), RD(5), FI(3,5), YI(3,5),
   13         1HI(3,5), HPRIM(30,5), HTRUE(30,5), FVERT(30,5),KM,KFX, AFAC(30,5),
   14         2HTR(50), FNSQ(50)
   15          IF (KM .LT. 1) GO TO 105
************
                    Number of difference sections found: 1
                    Number of difference records  found: 3
```

ESMOD.FOR

```
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]ESMOD.FOR;1
    8   C
    9          COMMON/SIGD/ DSL,ASM,DSU,AGLAT,DSLF,ASMF,DSUF,ACAV,FEAV,AFE,BFE
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]ESMOD.FOR;1
    8   c
    9          COMMON/ANOIS/ATNU,ATNY,CC,TM,RCNSE,DU,DL,SIGM,SXGU,SXGL,KJ,JK
   10          COMMON / CONTRL / IELECT(3), KTOUT(12), MONTHS(12), SUNSP(12),
   11         A IANTOU, ICARD, INTEG, IRED, ISOUT, ISPROC, ISSN, ITYPE, JDASH,
   12         B JFREQ, JLONG, KCARD, KRUN, MAPIN, MAXNAM, MONOLD, MOREM, MORES,
   13         C NUMNAM, NUPROC, MAXMET, mspec, ml00
   14          COMMON/SIGD/ DSL,ASM,DSU,AGLAT,DSLF,ASMF,DSUF,ACAV,FEAV,AFE,BFE
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]ESMOD.FOR;1
   17         1 GCDKM, PMP, PWR, RLAT, RLATD, RLONG, RLONGD, RSN, SIGTR, TLAT, TL
   18         2ATD, TLONG, TLONGD
   19          COMMON /RON /CLAT (5), CLONG (5), GLAT (5), RD (5), FI (3, 5), YI
   20         1(3, 5), HI (3, 5), HPRIM (30, 3), HTRUE (30, 3), FVERT (30, 3), KM
   21         2, KFX, AFAC (30, 3), HNOR (3)
   22          COMMON /RTANT /XETA, XSIG, XEPS, XND, XNL, XNH, TEX (4), ITANT, IR
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]ESMOD.FOR;1
   22         1 GCDKM, PMP, PWR, RLAT, RLATD, RLONG, RLONGD, RSN, SIGTR, TLAT,
   23         2 TLATD,TLONG,TLONGD,BRTD,FLUX,SSN,D90R,D50R,D10R,D90S,D50S,D10S
   24          COMMON /RON /CLAT(5), CLONG(5), GLAT(5), RD(5), FI(3,5), YI(3,5),
   25         1HI(3,5), HPRIM(30,5), HTRUE(30,5), FVERT(30,5),KM,KFX, AFAC(30,5),
   26         2HTR(50), FNSQ(50)
   27          COMMON /RTANT /XETA, XSIG, XEPS, XND, XNL, XNH, TEX (4), ITANT, IR
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]ESMOD.FOR;1
   25         1HN (7), HP (7), PROB (7), RELY (7), RGAIN (7), SIGPOW (7), SN (7),
   26         2 SPRO (7), TGAIN (7), TIMED (7), TLOSS (7), B (7), FSLOS (7), ADV
   27         C (7),OBF(7),NMODE(7),NPROB,NREL,TLLOW(7),TLHGH(7)
   28          COMMON /TON /ADJ, ADS, ATMO, GNOS, GOT, PWRDB, RCNSE, REL, SL, SLS
   29         1, SPR, SU, SUS, TIMER, XADJN, XEFF. XNOISE. XTLOS. ZNOISE. NF
   30          COMMON / FRQ / FREL(29), FREQ, JMODE
```

```
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]ESMOD.FOR;1
   30         1 HN(7), HP(7), PROB(7), RELY(7), RGAIN(7), SIGPOW(7), SN(7),
   31         2 SPRO(7), TGAIN(7), TIMED(7), TLOSS(7), B(7), FSLOS(7), ADV(7),
   32         3 OBF(7),NMODE(7),TLLOW(7),TLHGH(7)
   33          COMMON /TON /ADJ, ADS, GNOS, GOT, PWRDB, REL, SL, SLS
   34         1, SPR, SU, SUS, XNOISE, ZNOISE, NF
   35          COMMON / FRQ / FREL(29), FREQ, JMODE
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]ESMOD.FOR;1
   34          COMMON / RAYS / ANG(40), IFOB(40,30,3), NANG
   35          COMMON /TIME /IT, GMT, UTIME (24)
   36    C ES MODES
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]ESMOD.FOR;1
   39          COMMON / RAYS / ANG(40), IFOB(40,30,5), NANG
   40          COMMON / TIME / IT, GMT, UTIME(24), GMTR, XLMT(24), ITIM, JTX
   41    C ES MODES
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]ESMOD.FOR;1
  129    C.....UPPER DECILE - HPF
  130          ESD =  FS(3,K)* SECS
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]ESMOD.FOR;1
  134    C.....UPPER DECILE -   HPF
  135          ESD =  FS(3,K)* SECS
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]ESMOD.FOR;1
  151          CALL GAIN(1,KASANT,DEL,FREQ,STGAIN,STEFF)
  152          CALL GAIN(2,KASANT,DEL,FREQ,SRGAIN,DUMMY)
  153          EFF(IH) = DUMMY
  154     140  CONTINUE
  155          XTLOS = SFLOS + HOP*(SABPS + REF + ADX ) + (HOP -1.) * SGRLOS
  156         A    - SRGAIN  - STGAIN  + ASM
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]ESMOD.FOR;1
  156          if(mspec.ne.125)then
  157            CALL GAIN(1,KASANT,DEL,FREQ,STGAIN,STEFF)
  158            CALL GAIN(2,KASANT,DEL,FREQ,SRGAIN,DUMMY)
  159            EFF(IH) = DUMMY
  160          else
  161    c.....set gains and eff to 0 dB or unity
  162            stgain=0.
  163            srgain=0.
  164            eff(ih)=0.
  165          endif
  166     140  CONTINUE
  167          xtlos = SFLOS + HOP*(SABPS + REF + ADX ) + (HOP -1.) * SGRLOS
  168         A    - SRGAIN  - STGAIN  + ASM
************
                    Number of difference sections found: 6
                    Number of difference records  found: 31
```

```
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]ESREG.FOR;1
   13    C
   14          COMMON/MUFS/EMUF(24),F1MUF(24),F2MUF(24),ESMUF(24),ALLMUF(24)
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]ESREG.FOR;1
   13    c
   14          COMMON/ANOIS/ATNU,ATNY,CC,TM,RCNSE,DU,DL,SIGM,SXGU,SXGL,KJ,JK
   15          COMMON / CONTRL / IELECT(3), KTOUT(12), MONTHS(12), SUNSP(12),
   16         A IANTOU, ICARD, INTEG, IRED, ISOUT, ISPROC, ISSN, ITYPE, JDASH,
   17         B JFREQ, JLONG, KCARD, KRUN, MAPIN, MAXNAM, MONOLD, MOREM, MORES,
   18         C NUMNAM, NUPROC, MAXMET, mspec, m100
   19          COMMON/MUFS/EMUF(24),F1MUF(24),F2MUF(24),ESMUF(24),ALLMUF(24)
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]ESREG.FOR;1
   22         1 GCDKM, PMP, PWR, RLAT, RLATD, RLONG, RLONGD, RSN, SIGTR, TLAT, TL
   23         2ATD, TLONG, TLONGD
   24          COMMON /RON /CLAT (5), CLONG (5), GLAT (5), RD (5), FI (3, 5), YI
   25         1(3, 5), HI (3, 5), HPRIM (30, 3), HTRUE (30, 3), FVERT (30, 3), KM
   26         2, KFX, AFAC (30, 3), HNOR (3)
   27          COMMON / ZON / ABPS(7), CREL(7), EFF(7), FLDST(7), GRLOS(7),
   28         1HN (7), HP (7), PROB (7), RELY (7), RGAIN (7), SIGPOW (7), SN (7),
   29         2 SPRO (7), TGAIN (7), TIMED (7), TLOSS (7), B (7), FSLOS (7), ADV
   30         C (7),OBF(7),NMODE(7),NPROB,NREL,TLLOW(7),TLHGH(7)
   31          COMMON /TON /ADJ, ADS, ATMO, GNOS, GOT, PWRDB, RCNSE, REL, SL, SLS
   32         1, SPR, SU, SUS, TIMER, XADJN, XEFF, XNOISE, XTLOS, ZNOISE, NF
   33          COMMON/FRQ/FREL(29),FREQ,JMODE
   34          COMMON /ES /FS (3, 5), HS (5)
   35          COMMON / RAYS / ANG(40), IFOB(40,30,3), NANG
   36          COMMON /REFLX /DELFX (45, 3), HPFLX (45, 3), HTFLX (45, 3), GDFLX
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]ESREG.FOR;1
   27         1 GCDKM, PMP, PWR, RLAT, RLATD, RLONG, RLONGD, RSN, SIGTR, TLAT,
   28         2 TLATD,TLONG,TLONGD,BRTD,FLUX,SSN,D90R,D50R,D10R,D90S,D50S,D10S
   29          COMMON /RON /CLAT(5), CLONG(5), GLAT(5), RD(5), FI(3,5), YI(3,5),
   30         1HI(3,5), HPRIM(30,5), HTRUE(30,5), FVERT(30,5),KM,KFX, AFAC(30,5),
   31         2HTR(50), FNSQ(50)
   32          COMMON / ZON / ABPS(7), CREL(7), EFF(7), FLDST(7), GRLOS(7),
   33         1 HN(7), HP(7), PROB(7), RELY(7), RGAIN(7), SIGPOW(7), SN(7),
   34         2 SPRO(7), TGAIN(7), TIMED(7), TLOSS(7), B(7), FSLOS(7), ADV(7),
   35         3 OBF(7),NMODE(7),TLLOW(7),TLHGH(7)
   36          COMMON /TON /ADJ, ADS, GNOS, GOT, PWRDB, REL, SL, SLS
   37         1, SPR, SU, SUS, XNOISE, ZNOISE, NF
   38          COMMON/FRQ/FREL(29),FREQ,JMODE
   39          COMMON /ES /FS (3, 5), HS (5)
   40          COMMON / RAYS / ANG(40), IFOB(40,30,5), NANG
   41          COMMON /REFLX /DELFX (45, 3), HPFLX (45, 3), HTFLX (45, 3), GDFLX
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]ESREG.FOR;1
   39         C ,DELPEN(3,3)
   40          COMMON /GEOG /GYZ (5), RAT (5), GMDIP (5), CLCK (5), ABIY (5), ART
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]ESREG.FOR;1
   44         C ,DELPEN(3,5)
   45          COMMON /GEOG /GYZ (5), RAT (5), GMDIP (5), CLCK (5), ABIY (5), ART
```

ESREG.FOR (cont'd.)

```
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]ESREG.FOR;1
   78       95 CONTINUE
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]ESREG.FOR;1
   83    c
   84    c~~ESREG~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~nothing done here!!!~~~~~~~~~
   85    c                                          due to RETURN above
   86    c~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
   87       95 CONTINUE
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]ESREG.FOR;1
  274          CALL GAIN(1,KASANT,DEL,FREQ,DUMMY,TEFF)
  275          TGAIN(IMD) = DUMMY
  276          CALL GAIN(2,KASANT,DEL,FREQ,DUMMY1,DUMMY2)
  277          RGAIN(IMD) = DUMMY1
  278          EFF(IMD) = DUMMY2
  279          Y = 0.0
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]ESREG.FOR;1
  283          if(mspec.ne.125)then
  284            CALL GAIN(1,KASANT,DEL,FREQ,DUMMY,TEFF)
  285            TGAIN(IMD) = DUMMY
  286            CALL GAIN(2,KASANT,DEL,FREQ,DUMMY1,DUMMY2)
  287            RGAIN(IMD) = DUMMY1
  288            EFF(IMD) = DUMMY2
  289          else
  290    c.....set gains and eff to 0. dB or unity
  291            tgain(imd)=0.
  292            rgain(imd)=0.
  293            eff(imd)=0.
  294          endif
  295          Y = 0.0
************
                    Number of difference sections found: 5
                    Number of difference records  found: 37
```

ESVHF.FOR

```
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]ESVHF.FOR;1
   15          COMMON/RON/CLAT(5),CLONG(5),GLAT(5),RD(5),FI(3,5),YI(3,5),HI(3,5)
   16         A ,HPRIM(30,3),HTRUE(30,3),FVERT(30,3),KM,KFX,AFAC(30,3),HNOR(3),
   17         B  FX(3,5),HTR(50),FNSQ(50)
   18           COMMON/TON/ADJ,ADS,ATMO,GNOS,GOT,PWRDB,RCNSE,REL,SL,SLS,SPR,SU
   19         A ,SUS,TIMER,XADJN,XEFF,XNOIS,XTLOS,ZNOISE,NF
   20          COMMON/FRQ/FREL(29),FREQ,JMODE
   21          COMMON/TIME/IT,GMT,UTIME(24)
   22          COMMON/MUFS/EMUF(24),F1MUF(24),F2MUF(24),ESMUF(24),ALLMUF(24),FOT
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]ESVHF.FOR;1
   15          COMMON /RON /CLAT(5), CLONG(5), GLAT(5), RD(5), FI(3,5), YI(3,5),
   16         1HI(3,5), HPRIM(30,5), HTRUE(30,5), FVERT(30,5),KM,KFX, AFAC(30,5),
   17         2HTR(50), FNSQ(50)
   18           COMMON/TON/ADJ,ADS,GNOS,GOT,PWRDB,REL,SL,SLS,SPR,SU
   19         A ,SUS,XNOISe,ZNOISE,NF
```

ESVHF.FOR (cont'd.)

```
   20          COMMON/FRQ/FREL(29),FREQ,JMODE
   21          COMMON / TIME / IT, GMT, UTIME(24), GMTR, XLMT(24), ITIM, JTX
   22          COMMON/MUFS/EMUF(24),F1MUF(24),F2MUF(24),ESMUF(24),ALLMUF(24),FOT
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]ESVHF.FOR;1
   28          COMMON/ZON/ABPS(7),CREL(7),EFF(7),FLDST(7),GRLOS(7),HN(7),HP(7)
   29         A ,PROB(7),RELY(7),RGAIN(7),SIGPOW(7),SN(7),SPRO(7),TGAIN(7),TIMED
   30         B (7),TLOSS(7),B(7),FSLOS(7),ADV(7),OBF(7),NMODE(7),NPROB,NREL
   31         C ,TLLOW(7),TLHGH(7)
   32          COMMON/SIGD/DSL,ASM,DSU,AGLAT,DSLF,ASMF,DSUF,ACAV,FEAV,AFE,BFE
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]ESVHF.FOR;1
   28          COMMON / ZON / ABPS(7), CREL(7), EFF(7), FLDST(7), GRLOS(7),
   29         1 HN(7), HP(7), PROB(7), RELY(7), RGAIN(7), SIGPOW(7), SN(7),
   30         2 SPRO(7), TGAIN(7), TIMED(7), TLOSS(7), B(7), FSLOS(7), ADV(7),
   31         3 OBF(7),NMODE(7),TLLOW(7),TLHGH(7)
   32          COMMON/SIGD/DSL,ASM,DSU,AGLAT,DSLF,ASMF,DSUF,ACAV,FEAV,AFE,BFE
************
                    Number of difference sections found: 2
                    Number of difference records  found: 11
```

F2DIS.FOR

```
                    Number of difference sections found: 0
                    Number of difference records  found: 0
```

F2VAR.FOR

```
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]F2VAR.FOR;1
    8          COMMON /RON /CLAT (5), CLONG (5), GLAT (5), RD (5), FI (3, 5), YI
    9         1(3, 5), HI (3, 5), HPRIM (30, 3), HTRUE (30, 3), FVERT (30, 3), KM
   10         2, KFX
   11          COMMON /CON /AK, DCL, GAMA, PI, PI2, PIO2, BK, RZ, VOFL
   12          COMMON / GEOG / GY(5), RAT(5), GMDIP(5), CLCK(5), ABIY(5)
   13          COMMON/TIME/IT,GMT,UTIME(24)
   14          DATA XF1/1.1/,DELZ/2./
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]F2VAR.FOR;1
    8          COMMON /RON /CLAT(5), CLONG(5), GLAT(5), RD(5), FI(3,5), YI(3,5),
    9         1HI(3,5), HPRIM(30,5), HTRUE(30,5), FVERT(30,5),KM,KFX, AFAC(30,5),
   10         2HTR(50), FNSQ(50)
   11          COMMON /CON /AK, DCL, GAMA, PI, PI2, PIO2, BK, RZ, VOFL
   12          COMMON / GEOG / GY(5), RAT(5), GMDIP(5), CLCK(5), ABIY(5)
   13          COMMON / TIME / IT, GMT, UTIME(24), GMTR, XLMT(24), ITIM, JTX
   14          DATA XF1/1.1/,DELZ/2./
************
                    Number of difference sections found: 1
                    Number of difference records  found: 6
```

FDIST.FOR

```
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]FDIST.FOR;1
     9          COMMON/RON/CLAT(5),CLONG(5),GLAT(5),RD(5),FI(3,5),YI(3,5),HI(3,5)
    10         A ,HPRIM(30,3),HTRUE(30,3),FVERT(30,3),KM,KFX,AFAC(30,3),HNOR(3,5)
    11         B ,FX(3,5)
    12          COMMON /CON /D2R, DCL, GAMA, PI, PI2, PIO2, R2D, RZ, VOFL
    13          COMMON/DON/ALATD,AMIN,AMIND
    14          COMMON /FRQ /FREL (29), FREQ
    15          COMMON /REFLX /DELFX (45, 3), HPFLX (45, 3), HTFLX (45, 3), GDFLX
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]FDIST.FOR;1
     9          COMMON /RON /CLAT(5), CLONG(5), GLAT(5), RD(5), FI(3,5), YI(3,5),
    10         1HI(3,5), HPRIM(30,5), HTRUE(30,5), FVERT(30,5),KM,KFX, AFAC(30,5),
    11         2HTR(50), FNSQ(50)
    12          COMMON /CON /D2R, DCL, GAMA, PI, PI2, PIO2, R2D, RZ, VOFL
    13          COMMON /DON /ALATD, AMIN, AMIND, BTR, BTRD, DLONG, DMP, ERTR, GCD,
    14         1 GCDKM, PMP, PWR, RLAT, RLATD, RLONG, RLONGD, RSN, SIGTR, TLAT,
    15         2 TLATD,TLONG,TLONGD,BRTD,FLUX,SSN,D90R,D50R,D10R,D90S,D50S,D10S
    16          COMMON / FRQ / FREL(29), FREQ, JMODE
    17          COMMON /REFLX /DELFX (45, 3), HPFLX (45, 3), HTFLX (45, 3), GDFLX
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]FDIST.FOR;1
    20          COMMON / TIME / IT, GMT, UTIME(24), GMTR, XLMT(24)
    21    C     DHOP= HOP DISTANCE KM
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]FDIST.FOR;1
    22          COMMON / TIME / IT, GMT, UTIME(24), GMTR, XLMT(24), ITIM, JTX
    23    C     DHOP= HOP DISTANCE KM
************
                    Number of difference sections found: 2
                    Number of difference records  found: 9
```

FINDF.FOR

```
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]FINDF.FOR;1
    32          COMMON/DON/ALATD,AMIN,AMIND
    33          COMMON / FRQ / FREL(29), FREQ
    34          COMMON /REFLX /DELFX (45, 3), HPFLX (45, 3), HTFLX (45, 3), GDFLX
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]FINDF.FOR;1
    32    C  LONG PATH PARAMETERS,SEE SUBR LNGPAT.
    33          COMMON/LPATH/ GCDLNG,TGML(45),RGML(45),DELOPT,GMIN,YMIN,LTGM,LRGM
    34          COMMON /DON /ALATD, AMIN, AMIND, BTR, BTRD, DLONG, DMP, ERTR, GCD,
    35         1 GCDKM, PMP, PWR, RLAT, RLATD, RLONG, RLONGD, RSN, SIGTR, TLAT,
    36         2 TLATD,TLONG,TLONGD,BRTD,FLUX,SSN,D90R,D50R,D10R,D90S,D50S,D10S
    37          COMMON / FRQ / FREL(29), FREQ, JMODE
    38          COMMON /REFLX /DELFX (45, 3), HPFLX (45, 3), HTFLX (45, 3), GDFLX
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]FINDF.FOR;1
    37         3, DELPEN(3,3)
    38          COMMON/LOSX/ANDVX(45,3),ADVX(45,3),AOFX(45,3),ARFX(45,3),GRLOSX(
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]FINDF.FOR;1
    41         3, DELPEN(3,5)
    42          COMMON/LOSX/ANDVX(45,3),ADVX(45,3),AOFX(45,3),ARFX(45,3),GRLOSX(
```

FINDF.FOR (cont'd.)

```
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]FINDF.FOR;1
   43          COMMON /RON /CLAT (5), CLONG (5), GLAT (5), RD (5), FI (3, 5), YI
   44         1(3, 5), HI (3, 5), HPRIM (30, 3), HTRUE (30, 3), FVERT (30, 3), KM
   45         2, KFX, AFAC (30, 3), HNOR (3)
   46          COMMON/RAYS/ANG(40),IFOB(40,30,3),NANG
   47          DIMENSION ITYPE(3)
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]FINDF.FOR;1
   47          COMMON /RON /CLAT(5), CLONG(5), GLAT(5), RD(5), FI(3,5), YI(3,5),
   48         1HI(3,5), HPRIM(30,5), HTRUE(30,5), FVERT(30,5),KM,KFX, AFAC(30,5),
   49         2HTR(50), FNSQ(50)
   50          COMMON/RAYS/ANG(40),IFOB(40,30,5),NANG
   51          DIMENSION ITYPE(3)
************
                    Number of difference sections found: 3
                    Number of difference records  found: 11
```

FIXLIN.FOR

```
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]FIXLIN.FOR;1
    7         C NUMNAM, NUPROC, MAXMET
    8          COMMON / FILES / LUI, LUO, LU2, LU5, LU6, LU15, LU16, LU20, LU25,
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]FIXLIN.FOR;1
    7         C NUMNAM, NUPROC, MAXMET, mspec, m100
    8          COMMON / FILES / LUI, LUO, LU2, LU5, LU6, LU15, LU16, LU20, LU25,
************
                    Number of difference sections found: 1
                    Number of difference records  found: 1
```

FLOLIN.FOR

```
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]FLOLIN.FOR;1
    7         C NUMNAM, NUPROC, MAXMET
    8          COMMON / FILES / LUI, LUO, LU2, LU5, LU6, LU15, LU16, LU20, LU25,
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]FLOLIN.FOR;1
    7         C NUMNAM, NUPROC, MAXMET, mspec, m100
    8          COMMON / FILES / LUI, LUO, LU2, LU5, LU6, LU15, LU16, LU20, LU25,
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]FLOLIN.FOR;1
   19      120 WRITE(LUO,IFMT) VAR(IMUF), (VAR(I),I=1,ND), KLINE(LIN)
   20          RETURN
   21      130 WRITE(LUO,IFMT) VAR(IMUF), (VAR(I),I=1,JFREQ), (NDASH,J=1,JDASH),
   22         A KLINE(LIN)
   23      140 RETURN
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]FLOLIN.FOR;1
   19      120 WRITE(LUO,IFMT,IOSTAT=IERRSTAT) VAR(IMUF), (VAR(I),I=1,ND),
   20         A    KLINE(LIN)
   21    C      RETURN
   22           GO TO 140
   23      130 WRITE(LUO,IFMT,IOSTAT=IERRSTAT) VAR(IMUF),(VAR(I),I=1,JFREQ)
   24         A    ,(NDASH,J=1,JDASH),KLINE(LIN)
   25      140 RETURN
```

```
************
                    Number of difference sections found: 2
                    Number of difference records  found: 7
```

FNORML.FOR

```
                    Number of difference sections found: 0
                    Number of difference records  found: 0
```

FOBBY.FOR

```
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]FOBBY.FOR;1
     9          COMMON /DON /ALATD, AMIN, AMIND, BTR, BTRD, DLONG, DMP, ERTR, GLD,
    10         1 GCDKM, PMP, PWR, RLAT, RLATD, RLONG, RLONGD, RSN, SIGTR, TLAT, TL
    11         2ATD, TLONG, TLONGD
    12          COMMON /RON /CLAT (5), CLONG (5), GLAT (5), RD (5), FI (3, 5), YI
    13         1(3, 5), HI (3, 5), HPRIM (30, 3), HTRUE (30, 3), FVERT (30, 3), KM
    14         2 , KFX, AFAC(30,3), HNOR(3), FX(3,5), HTR(50), FNSQ(50)
    15          COMMON/RAYS/ANG(40),IFOB(40,30,3),NANG
    16          DO 650 IA=1,NANG
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]FOBBY.FOR;1
     9          COMMON /DON /ALATD, AMIN, AMIND, BTR, BTRD, DLONG, DMP, ERTR, GCD,
    10         1 GCDKM, PMP, PWR, RLAT, RLATD, RLONG, RLONGD, RSN, SIGTR, TLAT,
    11         2 TLATD,TLONG,TLONGD,BRTD,FLUX,SSN,D90R,D50R,D10R,D90S,D50S,D10S
    12          COMMON /RON /CLAT(5), CLONG(5), GLAT(5), RD(5), FI(3,5), YI(3,5),
    13         1HI(3,5), HPRIM(30,5), HTRUE(30,5), FVERT(30,5),KM,KFX, AFAC(30,5),
    14         2HTR(50), FNSQ(50)
    15          COMMON/RAYS/ANG(40),IFOB(40,30,5),NANG
    16          DO 650 IA=1,NANG
************
                    Number of difference sections found: 1
                    Number of difference records  found: 7
```

FRQCOM.FOR

```
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]FRQCOM.FOR;1
    10          COMMON/TIME/ IT,GMT,UTIME(24)
    11          DIMENSION FREA(13)
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]FRQCOM.FOR;1
    10          COMMON / TIME / IT, GMT, UTIME(24), GMTR, XLMT(24), ITIM, JTX
    11          DIMENSION FREA(13)
************
                    Number of difference sections found: 1
                    Number of difference records  found: 1
```

FVHF.FOR

```
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]FVHF.FOR;1
    13          COMMON / TON / ADJ, ADS, ATMO, GNOS, GOT, PWRDB, RCNSE, REL, SL,
    14         A SLS, SPR, SU, SUS, TIMER, XADJN, XEFF, XNOISE, XTLOS, ZNOISE, NF
    15          COMMON/FRQ/FREL(29),FREQ,JMODE
    16          COMMON/TIME/IT,GMT,UTIME(24)
    17          COMMON/MUFS/EMUF(24),F1MUF(24),F2MUF(24),ESMUF(24),ALLMUF(24),FOT
```

FVHF.FOR (cont'd.)

```
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]FVHF.FOR;1
   13          COMMON / TON / ADJ, ADS, GNOS, GOT, PWRDB, REL, SL,
   14         A SLS, SPR, SU, SUS, XNOISE, ZNOISE, NF
   15          COMMON/FRQ/FREL(29),FREQ,JMODE
   16          COMMON / TIME / IT, GMT, UTIME(24), GMTR, XLMT(24), ITIM, JTX
   17          COMMON/MUFS/EMUF(24),F1MUF(24),F2MUF(24),ESMUF(24),ALLMUF(24),FOT
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]FVHF.FOR;1
   22         A DBLOSL(13), DBLOSU(13), DBU(13), DELAY(13), NDBW(13), NHP(13),
   23         B NYNOIS(13), PROBMP(13), RELIAB(13), SNDB(13), SNPR(13),
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]FVHF.FOR;1
   22         A DBLOSL(13), DBLOSU(13), DBU(13), DELAY(13), DBW(13), NHP(13),
   23         B NYNOIS(13), PROBMP(13), RELIAB(13), SNDB(13), SNPR(13),
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]FVHF.FOR;1
   27          COMMON/ZON/ABPS(7),CREL(7),EFF(7),FLDST(7),GRLOS(7),HN(7),HP(7)
   28         A ,PROB(7),RELY(7),RGAIN(7),SIGPOW(7),SN(7),SPRO(7),TGAIN(7),TIMED
   29         B (7),TLOSS(7),B(7),FSLOS(7),ADV(7),OBF(7),NMODE(7),NPROB,NREL
   30         C ,TLLOW(7),TLHGH(7)
   31          COMMON/SIGD/DSL,ASM,DSU,AGLAT,DSLF,ASMF,DSUF,ACAV,FEAV,AFE,BFE
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]FVHF.FOR;1
   27          COMMON / ZON / ABPS(7), CREL(7), EFF(7), FLDST(7), GRLOS(7),
   28         1 HN(7), HP(7), PROB(7), RELY(7), RGAIN(7), SIGPOW(7), SN(7),
   29         2 SPRO(7), TGAIN(7), TIMED(7), TLOSS(7), B(7), FSLOS(7), ADV(7),
   30         3 OBF(7),NMODE(7),TLLOW(7),TLHGH(7)
   31          COMMON/SIGD/DSL,ASM,DSU,AGLAT,DSLF,ASMF,DSUF,ACAV,FEAV,AFE,BFE
************
```

Number of difference sections found: 3
Number of difference records found: 9

GAIN.FOR

Number of difference sections found: 0
Number of difference records found: 0

GENFAM.FOR

Number of difference sections found: 0
Number of difference records found: 0

GENION.FOR

```
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]GENION.FOR;1
   19          COMMON /DON /ALATD, AMIN, AMIND, BTR, BTRD, DLONG, DMP, ERTR, GLD,
   20         1 GCDKM, PMP, PWR, RLAT, RLATD, RLONG, RLONGD, RSN, SIGTR, TLAT, TL
   21         2ATD, TLONG, TLONGD
   22          COMMON /RON /CLAT (5), CLONG (5), GLAT (5), RD (5), FI (3, 5), YI
   23         1(3, 5), HI (3, 5), HPRIM (30, 3), HTRUE (30, 3), FVERT (30, 3), KM
   24         2 , KFX, AFAC(30,3), HNOR(3), FX(3,5), HTR(50), FNSQ(50)
   25          DIMENSION HTE(10),HPE(10)
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]GENION.FOR;1
   19          COMMON /DON /ALATD, AMIN, AMIND, BTR, BTRD, DLONG, DMP, ERTR, GCD,
   20         1 GCDKM, PMP, PWR, RLAT, RLATD, RLONG, RLONGD, RSN, SIGTR, TLAT,
   21         2 TLATD,TLONG,TLONGD,BRTD,FLUX,SSN,D90R,D50R,D10R,D90S,D50S,D10S
   22          COMMON /RON /CLAT(5), CLONG(5), GLAT(5), RD(5), FI(3,5), YI(3,5),
```

```
   23         1HI(3,5), HPRIM(30,5), HTRUE(30,5), FVERT(30,5),KM,KFX, AFAC(30,5),
   24         2HTR(50), FNSQ(50)
   25          DIMENSION HTE(10),HPE(10)
************
                    Number of difference sections found: 1
                    Number of difference records  found: 6
```

GENOIS.FOR

```
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]GENOIS.FOR;1
    3    C     THIS ROUTINE COMPUTES THE COMBINED NOISE DISTRIBUTION
    4    C
    5          COMMON /DON /ALATD, AMIN, AMIND, BTR, BTRD, DLONG, DMP, ERTR, GCD,
    6         1 GCDKM, PMP, PWR, RLAT, RLATD, RLONG, RLONGD, RSN, SIGTR, TLAT, TL
    7         2ATD, TLONG, TLONGD, BRTD, FLUX, SSN, ATMNO
    8          COMMON/ANOIS/ATNU,ATNY,CC,TM,XEFF,RCNSE,DU,DL,SIGM,SIGU,SIGL,KJ,JK
    9          COMMON /TON /ADJ, ADS, ATMO, GNOS, GOT, PWRDB, ZCNSE, REL, SL, SLS
   10         1, SPR, SU, SUS, TIMER, XADJN, ZEFF, XNOISE, XTLOS, ZNOISE, NF
   11          COMMON/FRQ/FREL(29),FREQ
   12          COMMON / ION / IANT(3,2), NTR(2), IEA, IFQB, IFQE, IGRAPH, IHRE,
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]GENOIS.FOR;1
    3    C     THIS ROUTINE COMPUTES THE COMBINED NOISE DISTRIBUTION - as
prescribed
    4    C       in ITS Report 87-212 "Updated Noise Model for use in IONCAP"
    5    C
    6    CQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQ
    7          COMMON / CONTRL / IELECT(3), KTOUT(12), MONTHS(12), SUNSP(12),
    8         A IANTOU, ICARD, INTEG, IRED, ISOUT, ISPROC, ISSN, ITYPE, JDASH,
    9         B JFREQ, JLONG, KCARD, KRUN, MAPIN, MAXNAM, MONOLD, MOREM, MORES,
   10         C NUMNAM, NUPROC, MAXMET, mspec, m100
   11          COMMON /DON /ALATD, AMIN, AMIND, BTR, BTRD, DLONG, DMP, ERTR, GCD,
   12         1 GCDKM, PMP, PWR, RLAT, RLATD, RLONG, RLONGD, RSN, SIGTR, TLAT,
   13         2 TLATD,TLONG,TLONGD,BRTD,FLUX,SSN,D90R,D50R,D10R,D90S,D50S,D10S
   14          COMMON/ANOIS/ATNU,ATNY,CC,TM,RCNSE,DU,DL,SIGM,SIGU,SIGL,KJ,JK
   15          COMMON /TON /ADJ, ADS, GNOS, GOT, PWRDB, REL, SL, SLS
   16         1, SPR, SU, SUS, XNOISE, ZNOISE, NF
   17          COMMON / FRQ / FREL(29), FREQ, JMODE
   18          COMMON / ION / IANT(3,2), NTR(2), IEA, IFQB, IFQE, IGRAPH, IHRE,
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]GENOIS.FOR;1
   15          COMMON / METSET / VERSN, ITRUN, ITOUT, JTRUN(40), JTOUT(40)
   16          COMMON /RON /CLAT (5), CLONG (5), GLAT (5), RD (5), FI (3, 5), YI
   17         1(3, 5), HI (3, 5), HPRIM (30, 3), HTRUE (30, 3), FVERT (30, 3), KM
   18         B ,KFX,AFAC(30,3),HNOR(3),FX(3,5)
   19          COMMON /RTANT /XETA, XSIG, XEPS, XND, XNL, XNH, TEX (4), ITANT, IR
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]GENOIS.FOR;1
   21          COMMON / METSET / VERSN, ITRUN, ITOUT, JTRUN(40), JTOUT(40), LSEAS
   22          COMMON /RON /CLAT(5), CLONG(5), GLAT(5), RD(5), FI(3,5), YI(3,5),
   23         1HI(3,5), HPRIM(30,5), HTRUE(30,5), FVERT(30,5),KM,KFX, AFAC(30,5),
   24         2HTR(50), FNSQ(50)
   25          COMMON /RTANT /XETA, XSIG, XEPS, XND, XNL, XNH, TEX (4), ITANT, IR
```

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**********
**********
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]GENOIS.FOR;1
   24         1HN (7), HP (7), PROB (7), RELY (7), RGAIN (7), SIGPOW (7), SN (7),
   25         2 SPRO (7), TGAIN (7), TIMED (7), TLOSS (7), B (7), FSLOS (7), ADV
   26         C (7),OBF(7),NMODE(7)
   27          DIMENSION XNINT(4)
   28    C.....MAN-MADE NOISE LEVELS
   29          DATA XNINT /125., 136., 148., 164./
   30    C.....BUT COMBINATION IS NOT
   31    C.....CALCULATION OF NOISE LEVEL IS ITSA-1
   32    C.....ATNU, ATNY ARE DB .GT. KTB FOR 1 MHZ
   33    C.....ATNZ, ATNX ARE DB .GT. KTB FOR FREQ
   34    C.....ATNOS, GNOS, XNOIS ARE DB .LT. 1 WATT IN 1 HZ BAND AT FREQ
   35    C.....UPPER LIMIT IS 55 MHZ FOR NOISE
   36           DUME = AMIN1(FREQ,55.)
   37          MAN=NOISE
   38    C  FREQUENCY DEPENDENCE ATMOSPHERIC NOISE
   39          IF(F2D(1,1,1)) 85, 90, 90
   40    C.....NO IONOSPHERIC LONG TERM DATA BASE FILE
   41    C.....FORCE MAN-MADE NOISE OR GALACTIC NOISE
   42       85 ATNOS = 204.
   43          DUA = 9.
   44          DLA = 7.
   45          SMA = 3.
   46          SUA = 1.5
   47          SLA = 1.5
   48          GO TO 95
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]GENOIS.FOR;1
   30         1 HN(7), HP(7), PROB(7), RELY(7), RGAIN(7), SIGPOW(7), SN(7),
   31         2 SPRO(7), TGAIN(7), TIMED(7), TLOSS(7), B(7), FSLOS(7), ADV(7),
   32         3 OBF(7),NMODE(7),TLLOW(7),TLHGH(7)
   33    CQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQ
   34          DIMENSION XNINT(4)
   35    C.....MAN-MADE NOISE LEVELS
   36          DATA XNINT /76.8, 72.5, 67.2, 53.6/
   37    C
   38          DATA DFAC,BFAC,CFAC /7.87384, 30.99872, 5.56765/
   39    C
   40    C        7.87384=SQRT(2 * 1.282**2 * 4.34294**2)
   41    C
   42    C       30.99872=(1.282**2)*(4.34294**2)
   43    C
   44    C        5.56765=4.34294 * 1.282
   45    C
   46    C.....DATA ARE FA VALUES AT 1 MHZ
   47    C
   48    C.....ATNU, ATNY ARE DB .GT. KTB FOR 1 MHZ
   49    C.....ATNZ, ATNX ARE DB .GT. KTB FOR FREQ
   50    C.....ATNOS, GNOS, XNOIS ARE DB .GT. KTB FOR ALL CALCULATIONS
   51    C.....AND ARE CONVERTED TO DBW(1 HZ BWDTH) AT END OF ROUTINE
   52    C.....UPPER LIMIT IS 55 MHZ FOR NOISE
   53          DUME=AMIN1(FREQ,55.)
   54          MAN=NOISE
   55    C
```

```
    C      FREQUENCY DEPENDENT ATMOSPHERIC NOISE
    C
          IF (F2D(1,1,1)) 85,90,90
    C.....NO IONOSPHERIC LONG TERM DATA BASE FILE
    C.....FORCE MAN-MADE NOISE OR GALACTIC NOISE
       85 ATNOS=204.
          DUA=9.
          DLA=7.
          SMA=3.
          SUA=1.5
          SLA=1.5
          GO TO 95
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]GENOIS.FOR;1
    C.....BEGIN OF INTERPOLATION ON LOCAL TIME
          SLOP = ABS(CC-TM)/4.
          ATNOS = - (ATNZ + (ATNX - ATNZ) * SLOP) + 204.
          DUA= DU +(DX-DU)*SLOP
          DLA= DL +(DQ-DL)*SLOP
            SMA= SIGM+ (SIGZ-SIGM)*SLOP
            SUA= SIGU +(SIGX-SIGU)*SLOP
            SLA= SIGL+(SIGSQ-SIGL)* SLOP
    C.....END OF INTERPOLATION ON LOCAL TIME
    C  GALACTIC NOISE
       95 IF(FREQ - FI(3,KFX)) 100, 100, 105
    C.....GALACTIC NOISE DOES NOT PENETRATE
      100 GNOS = 204.
          GO TO 110
      105 GNOS = 165. + 9.555 * ALOG(FREQ / 3.)
      110 DUG = 2.
          DLG =2.
          SMG = .5
          SUG = .2
          SLG = .2
    C  MAN MADE  NOISE
           MAN=NOISE
          XNOIS = MAN
          MA = IABS(MAN)
          ZNOISE=XNOIS
          IF(MAN) 120, 114, 115
    C.....INDICATES -164 ON USER INPUT
      114 MA = 4
          GO TO 120
    C.....ACTUAL VALUE IF POSITIVE ON USER INPUT
      115 XNOIS = XNOIS + 12.160 * ALOG(FREQ / 3.)
          MA= -MAN
          GO TO 125
    C.....NEGATIVE ON USER INPUT INDICATES INDEX
      120 MA = MIN0(4,MA)
          XNOIS = XNINT(MA) + 12.160 * ALOG(FREQ/3.)
          ZNOISE = XNINT(MA)
          MA= -XNINT(MA)
      125 DUM =9.
          DLM =7.
          SUM=1.5
          SMM=3.
          SLM=1.5
```

```
   96   C.....RECEIVER ANTENNA EFFICIENCY
   97         CALL GAIN(2,KASANT,0.0,FREQ,GDUM,REFF)
   98         XEFF = REFF
   99         ZEFF=XEFF
  100   C.....SET ARRAY FOR ALL POSSIBLE MODES
  101         DO 196 IM=1,6
  102     196 EFF(IM) = XEFF
  103   C.....NOW DETERMINATION OF NOISE LEVEL IS ITS-78(HFMUFES4)
  104   C.....SWITCH TO DB .GT. WATT
  105         ATNOS = - ATNOS
  106         GNOS = - GNOS
  107         XNOIS = - XNOIS
  108   C ADD THE NOISES (RANDOM PHASE APROXIMATION=ADD THE POWER IN WATTS)
  109   C.....MEDIAN
  110         XRNSE= 4.343*ALOG((10.**(ATNOS*.1)) + (10.**(GNOS*.1))
  111        A +(10.**(XNOIS*.1)))
  112   C  CALCULATE THE DECILES AND VARIANCE BY EQ. 37, P. 29 OF THE THEORY OF
  113   C  ERROR BY YARDLEY BEERS, MCGRAW HILL.
  114   C
  115   C.....UPPER DECILE
  116         DU= ABS(4.343*ALOG(10.**((ATNOS+DUA)*.1)  + 10.**((GNOS+DUG)*.1)
  117        A +10.**((XNOIS+DUM)*.1))- XRNSE)
  118   C.....LOWER DECILE
  119         DL= ABS( 4.343 *ALOG(10.**((ATNOS+DLA)*.1) +10.**((GNOS+DLG)*.1)
  120        A +10.**((XNOIS+DLM)*.1)) -XRNSE)
  121         IF(ITRUN - 8) 205, 210, 205
  122     205 QPA = 10. ** ((ATNOS - XRNSE) * .1)
  123         QPG = 10.**((GNOS -XRNSE)*.1)
  124   C.....PREDICTION ERRORS
  125   C.....SIGM IS MEDIAN, SIGU IS UPPER AND SIGL IS LOWER
  126         QPM = 10.**((XNOIS-XRNSE)*.1)
  127         SIGM= SQRT((QPA*SMA)**2 +(QPG*SMG)**2 +(QPM*SMM)**2)
  128         SIGU= SQRT((DUA*SUA*QPA**2/DU)**2 +(DUG*SUG*QPG**2/DU)**2
  129        A +(DUM*SUM*QPM**2/DU)**2)
  130         SIGL = SQRT((DLA*SLA*QPA**2/DL)**2 +(DLG*SLG*QPG**2/DL)**2
  131        A + (DLM * SLM * QPM ** 2 / DL) ** 2)
  132   C RCVR SITE NOISE = TOTAL NOISE + ANTENNA EFFICENCY (ADDED TO SIGNAL
  133   C   WITH GAIN)
  134     210 RCNSE = XRNSE + XEFF
  135         ZCNSE=RCNSE
  136         ATMNO=ATNOS
  137         XADJN=1.
  138         XNOISE=XNOIS
  139         ATMO=ATNOS
  140         RETURN
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]GENOIS.FOR;1
   72   C.....BEGIN INTERPOLATION ON LOCAL TIME
   73         SLOP=ABS(CC-TM)/4.
   74         ATNOS=ATNZ+(ATNX-ATNZ)*SLOP
   75         DUA=DU+(DX-DU)*SLOP
   76         DLA=DL+(DQ-DL)*SLOP
   77         SMA=SIGM+(SIGZ-SIGM)*SLOP
   78         SUA=SIGU+(SIGX-SIGU)*SLOP
   79         SLA=SIGL+(SIGSQ-SIGL)*SLOP
```

```
C.....END OF INTERPOLATION ON LOCAL TIME
C
C     (DUA/DFAC)**2=(DUA/1.282)**2/(2*4.34294**2)
C                  =(DUA/SQRT(2*1.282**2*4.34294**2))**2
C                  =(DUA/7.87384)**2
C
   95 AU=EXP((DUA/DFAC)**2+(ATNOS/4.34294))
      VU=AU*AU*(EXP(DUA*DUA/BFAC)-1.)
      AL=EXP((DLA/DFAC)**2+(ATNOS/4.34294))
C
C     DLA*DLA/BFAC=(DLA/1.282)**2/(4.34294)**2
C                 =DLA**2/30.99872
C
      VL=AL*AL*(EXP(DLA*DLA/BFAC)-1.)
C
C     GALACTIC NOISE
C
      IF (FREQ-FI(3,KFX)) 100,100,105
C.....GALACTIC NOISE DOES NOT PENETRATE
  100 GNOS=0.
      GO TO 110
  105 GNOS=52.-23.*ALOG10(FREQ)
  110 DUG=2.
      AT=EXP((DUG/DFAC)**2+(GNOS/4.34294))
      AU=AU+AT
      VU=VU+AT*AT*(EXP(DUG*DUG/BFAC)-1.)
      DLG=2.
      AT=EXP((DLG/DFAC)**2+(GNOS/4.34294))
      AL=AL+AT
      VL=VL+AT*AT*(EXP(DLG*DLG/BFAC)-1.)
      SMG=.5
      SUG=.2
      SLG=.2
C
C     MAN MADE NOISE
C
      MAN=NOISE
      XNOIS=MAN
      MA=IABS(MAN)
      ZNOISE=XNOIS
      IF (MAN) 120,114,115
C.....INDICATES -164 ON USER INPUT
  114 MA=4
      GO TO 120
C.....CONVERT 3 MHZ DB .LT. 1 WATT INPUT VALUE TO FA AT 1 MHZ
  115 XNOIS=204.0-XNOIS+13.22
C.....OBTAIN FA AT DESIRED FREQUENCY
      XNOIS=XNOIS-27.7*ALOG10(FREQ)
      GO TO 125
C.....NEGATIVE ON USER INPUT INDICATES INDEX
  120 MA=MIN0(4,MA)
      CONN=27.7
      IF (MA.EQ.4) CONN=28.6
      XNOIS=XNINT(MA)-CONN*ALOG10(FREQ)
      ZNOISE=204.0-XNINT(MA)+13.22
  125 DUM=9.7
      AT=EXP((DUM/DFAC)**2+(XNOIS/4.34294))
      AU=AU+AT
```

```
138         VU=VU+AT*AT*(EXP(DUM*DUM/BFAC)-1.)
139         DLM=6.
140         AT=EXP((DLM/DFAC)**2+(XNOIS/4.34294))
141         AL=AL+AT
142         VL=VL+AT*AT*(EXP(DLM*DLM/BFAC)-1.)
143         SUM=1.5
144         SMM=5.4
145         SLM=1.5
146   CQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQ
147   C.....RECEIVER ANTENNA EFFICIENCY
148         if(mspec.eq.125)then
149   c.......set rec eff to 0. dB or unity
150           reff=0.
151         else
152           CALL GAIN(2,KASANT,0.0,FREQ,GDUM,REFF)
153         endif
154   C.....SET ARRAY FOR ALL POSSIBLE MODES
155         DO 196 IM=1,6
156     196 EFF(IM) = REFF
157   CQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQ
158   C.....NOW DETERMINATION OF NOISE LEVEL IS ITS-78 (HFMUFES4)
159   C.....SWITCH TO DB .GT. WATT
160         ATNOS=ATNOS-204.
161         GNOS=GNOS-204.
162         XNOIS=XNOIS-204.
163         SIGTSQ=ALOG(1.+VU/(AU*AU))
164         XRNSE=4.34294*(ALOG(AU)-SIGTSQ/2.)-204.
165   C.....UPPER DECILE
166   C
167   C       CFAC=4.34294*1.282
168   C           =5.56765
169   C
170         DU=CFAC*SQRT(SIGTSQ)
171         SIGTSQ=ALOG(1.+VL/(AL*AL))
172   C.....LOWER DECILE
173         DL=CFAC*SQRT(SIGTSQ)
174         IF (ITRUN-8) 205,210,205
175     205 QPA=10.**((ATNOS-XRNSE)*0.1)
176         QPG=10.**((GNOS-XRNSE)*0.1)
177   C.....PREDICTION ERRORS
178   C.....SIGM IS MEDIAN, SIGU IS UPPER AND SIGL IS LOWER
179         QPM=10.**((XNOIS-XRNSE)*0.1)
180         SIGM=SQRT((QPA*SMA)**2+(QPG*SMG)**2+(QPM*SMM)**2)
181   C
182   C       0.23026=1.0/4.34294
183   C
184         PV=QPA*EXP((DUA-DU)*0.23026)
185         SIGU=(PV*SUA)**2+((PV-QPA)*SMA)**2
186         PV=QPG*EXP((DUG-DU)*0.23026)
187         SIGU=SIGU+(PV*SUG)**2+((PV-QPG)*SMG)**2
188         PV=QPM*EXP((DUM-DU)*0.23026)
189         SIGU=SQRT(SIGU+(PV*SUM)**2+((PV-QPM)*SMM)**2)
190         PV=QPA*EXP((DLA-DL)*0.23026)
191         SIGL=(PV*SLA)**2+((PV-QPA)*SMA)**2
192         PV=QPG*EXP((DLG-DL)*0.23026)
193         SIGL=SIGL+(PV*SLG)**2+((PV-QPG)*SMA)**2
194         PV=QPM*EXP((DLM-DL)*0.23026)
195         SIGL=SQRT(SIGL+(PV*SLM))**2 +((PV-QPM)*SMM)**2
```

```
  196   C
  197   C     RCVR SITE NOISE = TOTAL NOISE + ANTENNA EFFICENCY (ADDED TO
  198   C                       SIGNAL WITH GAIN)
  199   C
  200   CQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQ
  201     210 RCNSE = XRNSE + REFF
  202         XNOISE=XNOIS
  203   CQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQQ
  204         RETURN
************
                    Number of difference sections found: 4
                    Number of difference records  found: 188
```

GEOM.FOR

```
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]GEOM.FOR;1
   11        1 GCDKM, PMP, PWR, RLAT, RLATD, RLONG, RLONGD, RSN, SIGTR, TLAT, TL
   12        2ATD, TLONG, TLONGD, BRTD, FLUX, SSN, ATMNO
   13         COMMON /ION/ IANT(3,2), NTR(2), IEA, IFQB, IFQE, IGRAPH, IHRE,
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]GEOM.FOR;1
   11        1 GCDKM, PMP, PWR, RLAT, RLATD, RLONG, RLONGD, RSN, SIGTR, TLAT,
   12        2 TLATD,TLONG,TLONGD,BRTD,FLUX,SSN,D90R,D50R,D10R,D90S,D50S,D10S
   13         COMMON /ION/ IANT(3,2), NTR(2), IEA, IFQB, IFQE, IGRAPH, IHRE,
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]GEOM.FOR;1
   16         COMMON /RON /CLAT (5), CLONG (5), GLAT (5), RD (5), FI (3, 5), YI
   17        1(3, 5), HI (3, 5), HPRIM (30, 3), HTRUE (30, 3), FVERT (30, 3), KM
   18        2, KFX
   19         COMMON/GEOG/ GYZ(5), RAT(5), GMDIP(5), CLCK(5), ABIY(5), ARTIC(5),
   20        1 SIGPAT(5), EPSPAT(5)
   21         COMMON / METSET / VERSN, ITRUN, ITOUT, JTRUN(40), JTOUT(40)
   22         COMMON / OUTLAB / LABEL(11), LAYTYP(5), IEAST, INORTH, ISOUTH,
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]GEOM.FOR;1
   16         COMMON /RON /CLAT(5), CLONG(5), GLAT(5), RD(5), FI(3,5), YI(3,5),
   17        1HI(3,5), HPRIM(30,5), HTRUE(30,5), FVERT(30,5),KM,KFX, AFAC(30,5),
   18        2HTR(50), FNSQ(50)
   19         COMMON/GEOG/ GYZ(5), RAT(5), GMDIP(5), CLCK(5), ABIY(5), ARTIC(5),
   20        1 SIGPAT(5), EPSPAT(5)
   21         COMMON / METSET / VERSN, ITRUN, ITOUT, JTRUN(40), JTOUT(40), LSEAS
   22         COMMON / OUTLAB / LABEL(11), LAYTYP(5), IEAST, INORTH, ISOUTH,
************
                    Number of difference sections found: 2
                    Number of difference records  found: 8
```

GEOTIM.FOR

```
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]GEOTIM.FOR;1
    1         SUBROUTINE GEOTIM(ITIM,JT)
    2   C
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]GEOTIM.FOR;1
    1         SUBROUTINE GEOTIM(JT)
    2   C
************
************
```

GEOTIM.FOR (cont'd.)

```
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]GEOTIM.FOR;1
     6          COMMON / DON / ALATD, AMIN, AMIND, BTR, BTRD, DLONG, DMP, ERTR,
     7         1 GCD, GCDKM, PMP, PWR, RLAT, RLATD, RLONG, RLONGD, RSN, SIGTR,
     8         2 TLAT, TLATD, TLONG, TLONGD, BRTD, FLUX, SSN, ATMNO
     9          COMMON / GEOG / GYZ(5), RAT(5), GMDIP(5), CLCK(5), ABIY(5),
    10         1 ARTIC(5), SIGPAT(5), EPSPAT(5)
    11          COMMON / RON / CLAT(5), CLONG(5), GLAT(5), RD(5), FI(3,5),
    12         1 YI(3,5), HI(3,5), HPRIM(30,3), HTRUE(30,3), FVERT(30,3), KM, KFX,
    13         2 AFAC(30,3), HNOR(3), FX(3,5), HTR(50), FNSQ(50)
    14          COMMON / TIME / IT, GMT, UTIME(24), GMTR, XLMT(24)
    15          CKC = JT
    16    C.....ITIM IS SPECIFIED ON THE "TIME" CONTROL CARD.
    17    C.....IF ITIM .LT.0 USE LMT SO CALCULATE UT HERE
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]GEOTIM.FOR;1
     6          COMMON /DON /ALATD, AMIN, AMIND, BTR, BTRD, DLONG, DMP, ERTR, GCD,
     7         1 GCDKM, PMP, PWR, RLAT, RLATD, RLONG, RLONGD, RSN, SIGTR, TLAT,
     8         2 TLATD,TLONG,TLONGD,BRTD,FLUX,SSN,D90R,D50R,D10R,D90S,D50S,D10S
     9          COMMON / GEOG / GYZ(5), RAT(5), GMDIP(5), CLCK(5), ABIY(5),
    10         1 ARTIC(5), SIGPAT(5), EPSPAT(5)
    11          COMMON /RON /CLAT(5), CLONG(5), GLAT(5), RD(5), FI(3,5), YI(3,5),
    12         1HI(3,5), HPRIM(30,5), HTRUE(30,5), FVERT(30,5),KM,KFX, AFAC(30,5),
    13         2HTR(50), FNSQ(50)
    14          COMMON / TIME / IT, GMT, UTIME(24), GMTR, XLMT(24), ITIM, JTX
    15          CKC = JT
    16    C.....IITIM IS SPECIFIED ON THE "TIME" CONTROL CARD.
    17    C.....IF ITIM .LT.0 USE LMT SO CALCULATE UT HERE
************
                    Number of difference sections found: 2
                    Number of difference records  found: 12
```

GETANT.FOR

```
                    Number of difference sections found: 0
                    Number of difference records  found: 0
```

GETHP.FOR

```
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]GETHP.FOR;1
     8          COMMON /DON /ALATD, AMIN, AMIND, BTR, BTRD, DLONG, DMP, ERTR, GLD,
     9         1 GCDKM, PMP, PWR, RLAT, RLATD, RLONG, RLONGD, RSN, SIGTR, TLAT, TL
    10         2ATD, TLONG, TLONGD
    11          COMMON /RON /CLAT (5), CLONG (5), GLAT (5), RD (5), FI (3, 5), YI
    12         1(3, 5), HI (3, 5), HPRIM (30, 3), HTRUE (30, 3), FVERT (30, 3), KM
    13         2 , KFX, AFAC(30,3), HNOR(3), FX(3,5), HTR(50), FNSQ(50)
    14          FR = FXX * FXX
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]GETHP.FOR;1
     8          COMMON /DON /ALATD, AMIN, AMIND, BTR, BTRD, DLONG, DMP, ERTR, GCD,
     9         1 GCDKM, PMP, PWR, RLAT, RLATD, RLONG, RLONGD, RSN, SIGTR, TLAT,
    10         2 TLATD,TLONG,TLONGD,BRTD,FLUX,SSN,D90R,D50R,D10R,D90S,D50S,D10S
    11          COMMON /RON /CLAT(5), CLONG(5), GLAT(5), RD(5), FI(3,5), YI(3,5),
    12         1HI(3,5), HPRIM(30,5), HTRUE(30,5), FVERT(30,5),KM,KFX, AFAC(30,5),
    13         2HTR(50), FNSQ(50)
    14          FR = FXX * FXX
************
                    Number of difference sections found: 1
                    Number of difference records  found: 6
```

GETKMF.FOR

```
                    Number of difference sections found: 0
                    Number of difference records  found: 0
```

GETTOP.FOR

```
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]GETTOP.FOR;1
     7          COMMON/FRQ/FREL(29),FREQ
     8          COMMON/LPATH/ GCDLNG,TGML(45),RGML(45),DELOPT,GMIN,YMIN,LTGM,LRGM
     9          COMMON/RON/CLAT(5),CLONG(5),GLAT(5),RD(5),FI(3,5),YI(3,5),HI(3,5)
    10         A ,HPRIM(30,3),HTRUE(30,3),FVERT(30,3),KM,KFX,AFAC(30,3),HNOR(3)
    11         B ,FX(3,5)
    12          DIMENSION FPE(3)
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]GETTOP.FOR;1
     7          COMMON / FRQ / FREL(29), FREQ, JMODE
     8          COMMON/LPATH/ GCDLNG,TGML(45),RGML(45),DELOPT,GMIN,YMIN,LTGM,LRGM
     9          COMMON /RON /CLAT(5), CLONG(5), GLAT(5), RD(5), FI(3,5), YI(3,5),
    10         1HI(3,5), HPRIM(30,5), HTRUE(30,5), FVERT(30,5),KM,KFX, AFAC(30,5),
    11         2HTR(50), FNSQ(50)
    12          DIMENSION FPE(3)
************
                    Number of difference sections found: 1
                    Number of difference records  found: 5
```

GMLOSS.FOR

```
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]GMLOSS.FOR;1
     5          COMMON/DON/ALATD,AMIN,AMIND
     6          COMMON/RAYS/ANG(40),IFOB(40,30,3),NANG
     7          COMMON/LPATH/ GCDLNG,TGML(45),RGML(45),DELOPT,GMIN,YMIN,LTGM,LRGM
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]GMLOSS.FOR;1
     5          COMMON /DON /ALATD, AMIN, AMIND, BTR, BTRD, DLONG, DMP, ERTR, GCD,
     6         1 GCDKM, PMP, PWR, RLAT, RLATD, RLONG, RLONGD, RSN, SIGTR, TLAT,
     7         2 TLATD,TLONG,TLONGD,BRTD,FLUX,SSN,D90R,D50R,D10R,D90S,D50S,D10S
     8          COMMON/RAYS/ANG(40),IFOB(40,30,5),NANG
     9          COMMON/LPATH/ GCDLNG,TGML(45),RGML(45),DELOPT,GMIN,YMIN,LTGM,LRGM
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]GMLOSS.FOR;1
    12         B ,ISKP(3),IMODE(45,3),AFFLX(45,3),DELPEN(3,3)
    13          COMMON / ZON / ABPS(7), CREL(7), EFF(7), FLDST(7), GRLOS(7),
    14         1HN (7), HP (7), PROB (7), RELY (7), RGAIN (7), SIGPOW (7), SN (7),
    15         2 SPRO (7), TGAIN (7), TIMED (7), TLOSS (7), B (7), FSLOS (7), ADV
    16         C (7),OBF(7),NMODE(7)
    17    C.....PRESET ALL ARRAYS
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]GMLOSS.FOR;1
    14         B ,ISKP(3),IMODE(45,3),AFFLX(45,3),DELPEN(3,5)
    15          COMMON / ZON / ABPS(7), CREL(7), EFF(7), FLDST(7), GRLOS(7),
    16         1 HN(7), HP(7), PROB(7), RELY(7), RGAIN(7), SIGPOW(7), SN(7),
    17         2 SPRO(7), TGAIN(7), TIMED(7), TLOSS(7), B(7), FSLOS(7), ADV(7),
    18         3 OBF(7),NMODE(7),TLLOW(7),TLHGH(7)
    19    C.....PRESET ALL ARRAYS
************
                    Number of difference sections found: 2
                    Number of difference records  found: 9
```

GPHBOD.FOR

```
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]GPHBOD.FOR;1
   14          COMMON / TIME / ITDUM, GMT, UTIME(24), GMTR, XLMT(24)
   15          CHARACTER IHR(40)*2, IBLANK*6, ISYMBL*6, JSYMBL*6, KSYMBL*6,
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]GPHBOD.FOR;1
   14          COMMON / TIME / IT, GMT, UTIME(24), GMTR, XLMT(24), ITIM, JTX
   15          CHARACTER IHR(40)*2, IBLANK*6, ISYMBL*6, JSYMBL*6, KSYMBL*6,
************
                    Number of difference sections found: 1
                    Number of difference records  found: 1
```

HFMUFS.FOR

```
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]HFMUFS.FOR;1
    6          COMMON / CONTRL / IELECT(3), KTOUT(12), MONTHS(12), SUNSP(12),
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]HFMUFS.FOR;1
    6          COMMON / ALPHA / IMON(12), IRCVR(2), ITRAN(2), MODE(13),
    7         A MODER(13), MODVHF(13), IRLAT, IRLONG, ITLAT, ITLONG, NYEAR
    8          CHARACTER IMON*3
    9          CHARACTER IRCVR*10, ITRAN*10, MODE*2, MODER*2, MODVHF*2, IRLAT*1,
   10         A IRLONG*1, ITLAT*1, ITLONG*1, NYEAR*5
   11          COMMON / CONTRL / IELECT(3), KTOUT(12), MONTHS(12), SUNSP(12),
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]HFMUFS.FOR;1
    9         C NUMNAM, NUPROC, MAXMET
   10          COMMON / FILES / LUI, LUO, LU2, LU5, LU6, LU15, LU16, LU20, LU25,
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]HFMUFS.FOR;1
   14         C NUMNAM, NUPROC, MAXMET, mspec, m100
   15          COMMON / FILES / LUI, LUO, LU2, LU5, LU6, LU15, LU16, LU20, LU25,
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]HFMUFS.FOR;1
   15          COMMON / DON / ALATD, AMIN, AMIND, BTR, BTRD, DLONG, DMP, ERTR,
   16         1 GCD, GCDKM, PMP, PWR, RLAT, RLATD, RLONG, RLONGD, RSN, SIGTR,
   17         2 TLAT, TLATD, TLONG, TLONGD, BRTD, FLUX, SSN, ATMNO
   18          COMMON / FRQ / FREL(29), FREQ
   19          COMMON / ION / IANT(3,2), NTR(2), IEA, IFQB, IFQE, IGRAPH, IHRE,
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]HFMUFS.FOR;1
   20          COMMON /DON /ALATD, AMIN, AMIND, BTR, BTRD, DLONG, DMP, ERTR, GCD,
   21         1 GCDKM, PMP, PWR, RLAT, RLATD, RLONG, RLONGD, RSN, SIGTR, TLAT,
   22         2 TLATD,TLONG,TLONGD,BRTD,FLUX,SSN,D90R,D50R,D10R,D90S,D50S,D10S
   23          COMMON / FRQ / FREL(29), FREQ, JMODE
   24          COMMON / ION / IANT(3,2), NTR(2), IEA, IFQB, IFQE, IGRAPH, IHRE,
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]HFMUFS.FOR;1
   22          COMMON / METSET / VERSN, ITRUN, ITOUT, JTRUN(40), JTOUT(40)
   23          COMMON / MUFS / EMUF(24), F1MUF(24), F2MUF(24), ESMUF(24),
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]HFMUFS.FOR;1
   27          COMMON / METSET / VERSN, ITRUN, ITOUT, JTRUN(40), JTOUT(40), LSEAS
   28          COMMON / MUFS / EMUF(24), F1MUF(24), F2MUF(24), ESMUF(24),
************
************
```

```
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]HFMUFS.FOR;1
   28   C.....START OF PROGRAM
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]HFMUFS.FOR;1
   33          COMMON / SSP / SUN(2,12), MONTH
   34          COMMON/TON/ADJ,ADS,GNOS,GOT,PWRDB,REL,SL,SLS,SPR,SU,SUS
   35         A ,XNOISE,ZNOISE,NF
   36          common/indicez/ispot,iseaz,ifqn,iour,inmmd(11,24,4,2)
   37          character*13 filnam
   38          data filnam/'xmtrddddd.alm'/
   39   C.....START OF PROGRAM
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]HFMUFS.FOR;1
   65   C.....BEGIN HOUR LOOP
   66          DO 400 JT = IHRO,IHRE,IHRS
   67          JTX = JT
   68   C.....CONVERT UT TO LMT, ETC.
   69          CALL GEOTIM(ITIM,JT)
   70   C.....WANT TO USE LONG TERM COEFFICIENTS
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]HFMUFS.FOR;1
   76          if(filnam(1:9).ne.itran(1)(1:9))then
   77            if(filnam(1:9).ne.'xmtrddddd')then
   78              if(mspec.eq.125)then
   79                close(m100)
   80                write(luo,129)(((ispot,iseaz,iour,(inmmd(ifqn,iour,
   81        +       iseaz,ispot),ifqn=1,11),iour=1,24),iseaz=1,4),ispot=1,2)
   82    129         format(8(1x,'ispot,iseaz,iour,    (>>--num modes(ifqn=1,,,',
   83        +       '11)---->>)',/,24(2x,3(i2,3x),3x,11i3,/),/))
   84              endif
   85            endif
   86            filnam(1:9)=itran(1)(1:9)
   87            if(mspec.eq.125)then
   88   c.........Power set to 1 Watt
   89              pwr=.001
   90              pwrdb=0.
   91              open(m100,file=filnam,status='new',form='unformatted')
   92              write(m100)tlatd,itlat,tlongd,itlong,rlatd,irlat,
   93        +     rlongd,irlong,btrd,gcdkm,rsn,lufp,nyear
   94              write(m100)ssn
   95              write(m100)month
   96            endif
   97            ssnsav=ssn
   98            monsav=month
   99            do 128 ispot=1,2
  100            do 128 iseaz=1,4
  101            do 128 iour=1,24
  102            do 128 ifqn=1,11
  103     128    inmmd(ifqn,iour,iseaz,ispot)=-1
  104            ispot=1
  105            iseaz=1
  106          endif
  107          if(ssn.ne.ssnsav)then
  108            if(mspec.eq.125)write(m100)ssn
  109            ssnsav=ssn
  110            ispot=ispot+1
  111          endif
```

```
  112          if(month.ne.monsav)then
  113            if(mspec.eq.125)write(m100)month
  114            monsav=month
  115            iseaz=iseaz+1
  116            if(iseaz.gt.4)iseaz=iseaz-4
  117          endif
  118    C.....BEGIN HOUR LOOP
  119          DO 400 JT = IHRO,IHRE,IHRS
  120          iour=jt
  121          JTX = JT
  122    C.....CONVERT UT TO LMT, ETC.
  123          CALL GEOTIM(JT)
  124          if(mspec.eq.125)write(m100)gmt
  125    C.....WANT TO USE LONG TERM COEFFICIENTS
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]HFMUFS.FOR;1
  110    C.....FORCE LONG PATH MODEL IF PATH LENGTH .GT. SPECIFIED LIMIT
  111      215 IF(GCDKM - GCDLNG) 220, 240, 240
  112    C.....SHORT PATH MODEL (CHASE MODES)
  113      220 IF(METHOD - 21) 230, 245, 230
  114      230 CALL LUFFY
  115          CALL SETLUF
  116          GO TO 300
  117      240 IF(METHOD - 22) 245, 230, 245
  118    C.....LONG PATH MODEL
  119      245 CALL LNGLUF
  120          CALL SETLUF
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]HFMUFS.FOR;1
  165      215 IF(METHOD.EQ.22)THEN
  166    C.......FORCE SHORT PATH MODEL
  167            IPFG=100
  168          ELSE IF(METHOD.EQ.21)THEN
  169    C.......FORCE LONG PATH MODEL
  170            IPFG=200
  171          ELSE
  172    C.......FORCE LONG PATH MODEL IF PATH LENGTH .GT. SPECIFIED LIMIT
  173            IPFG=100
  174            IF(GCDKM.GE.GCDLNG)IPFG=200
  175          ENDIF
  176          CALL LUFFY(IPFG)
  177          CALL SETLUF
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]HFMUFS.FOR;1
  124      255 IF(GCDKM-GCDLNG) 256,257,257
  125      256 CALL SETLUF
  126          GO TO 260
  127      257 CALL GETLUF
  128      260 CONTINUE
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]HFMUFS.FOR;1
  181      255 IPFG=300
  182          IF(GCDKM.GE.GCDLNG)IPFG=400
  183          CALL LUFFY(IPFG)
  184      260 CONTINUE
```

HFMUFS.FOR (cont'd.)

```
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]HFMUFS.FOR;1
  131      300 IF(ITOUT - 7) 310, 305, 310
  132    C.....OUTPUT PRINTED LINES DEPENDENT ON METHOD
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]HFMUFS.FOR;1
  187      300 if(mspec.eq.125)go to 400
  188          IF(ITOUT - 7) 310, 305, 310
  189    C.....OUTPUT PRINTED LINES DEPENDENT ON METHOD
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]HFMUFS.FOR;1
  215          STOP
  216     1504 FORMAT('1','*****END OF RUN*****',5X,'IONCAP ',F5.2)
  217          END
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]HFMUFS.FOR;1
  272          if(mspec.eq.125)then
  273            write(luo,129)(((ispot,iseaz,iour,(inmmd(ifqn,iour,
  274         +  iseaz,ispot),ifqn=1,11),iour=1,24),iseaz=1,4),ispot=1,2)
  275            close(m100)
  276          endif
  277          STOP
  278     1504 FORMAT(1H1,'*****END OF RUN*****',5X,'IONCAP ',F5.2)
  279          END
************
                    Number of difference sections found: 10
                    Number of difference records  found: 91
```

INMOD.FOR

```
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]INMOD.FOR;1
    1          SUBROUTINE INMOD(JFX)
    2    C.....THIS SUBROUTINE ADDS AN OVER-THE-MUF MODE
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]INMOD.FOR;1
    1          SUBROUTINE INMOD(JFX,iflg)
    2    C.....THIS SUBROUTINE ADDS AN OVER-THE-MUF MODE
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]INMOD.
    5          COMMON / CON / D2R, DCL, GA..., ..., PI2, PIO2, R2D, RZ, VOFL
    6    C..... /DON/ IS TRUNCATED
    7          COMMON/DON/ALATD,AMIN,AMIND,BTR,BTRD,DLONG,DMP,ERTR,GCD
    8         A , ZZDUM(23)
    9          COMMON / FILES / LUI, LUO, LU2, LU5, LU6, LU15, LU16, LU20, LU25,
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]INMOD.FOR;1
    5    c
    6          COMMON / CONTRL / IELECT(3), KTOUT(12), MONTHS(12), SUNSP(12),
    7         A IANTOU, ICARD, INTEG, IRED, ISOUT, ISPROC, ISSN, ITYPE, JDASH,
    8         B JFREQ, JLONG, KCARD, KRUN, MAPIN, MAXNAM, MONOLD, MOREM, MORES,
    9         C NUMNAM, NUPROC, MAXMET, mspec, m100
   10          COMMON / CON / D2R, DCL, GAMA, PI, PI2, PIO2, R2D, RZ, VOFL
   11          COMMON /DON /ALATD, AMIN, AMIND, BTR, BTRD, DLONG, DMP, ERTR, GCD,
   12         1 GCDKM, PMP, PWR, RLAT, RLATD, RLONG, RLONGD, RSN, SIGTR, TLAT,
   13         2 TLATD,TLONG,TLONGD,BRTD,FLUX,SSN,D90R,D50R,D10R,D90S,D50S,D10S
   14          COMMON / FILES / LUI, LUO, LU2, LU5, LU6, LU15, LU16, LU20, LU25,
```

```
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]INMOD.FOR;1
   18          COMMON/RON/ CLAT(5),CLONG(5),GLAT(5),RD(5),FI(3,5),YI(3,5)
   19         A ,HI(3,5),HPRIM(30,3),HTRUE(30,3),FVERT(30,3),KM,KFX,AFAC(30,3)
   20         B ,HNOR(3)
   21          COMMON / SON / ANGLE(13), ANGLER(13), CPROB(13), DBLOS(13),
   22         A DBLOSL(13), DBLOSU(13), DBU(13), DELAY(13), NDBW(13), NHP(13),
   23         B NYNOIS(13), PROBMP(13), RELIAB(13), SNDB(13), SNPR(13),
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]INMOD.FOR;1
   23          COMMON /RON /CLAT(5), CLONG(5), GLAT(5), RD(5), FI(3,5), YI(3,5),
   24         1HI(3,5), HPRIM(30,5), HTRUE(30,5), FVERT(30,5),KM,KFX, AFAC(30,5),
   25         2HTR(50), FNSQ(50)
   26          COMMON / SON / ANGLE(13), ANGLER(13), CPROB(13), DBLOS(13),
   27         A DBLOSL(13), DBLOSU(13), DBU(13), DELAY(13), DBW(13), NHP(13),
   28         B NYNOIS(13), PROBMP(13), RELIAB(13), SNDB(13), SNPR(13),
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]INMOD.FOR;1
   27         A HN(7), HP(7), PROB(7), RELY(7), RGAIN(7), SIGPOW(7), SN(7),
   28         B SPRO(7), TGAIN(7), TIMED(7), TLOSS(7), B(7), FSLOS(7), ADV(7),
   29         C OBF(7), NMODE(7), NPROB, NREL, TLLOW(7), TLHGH(7)
   30    C
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]INMOD.FOR;1
   32         1 HN(7), HP(7), PROB(7), RELY(7), RGAIN(7), SIGPOW(7), SN(7),
   33         2 SPRO(7), TGAIN(7), TIMED(7), TLOSS(7), B(7), FSLOS(7), ADV(7),
   34         3 OBF(7),NMODE(7),TLLOW(7),TLHGH(7)
   35    C
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]INMOD.FOR;1
   33    C.....RETURN IF THERE ALREADY IS A MODE
   34          IF( NHP(JFX) ) 110,110,105
   35    C   YES,
   36      105 CONTINUE
   37           RETURN
   38    C.....THERE IS NO MODE PRESENT, CHECK IF FREQUENCY IS ABOVE CIRCUIT MUF
   39      110 IF(FREQ - ALLMUF(IT) + EPS)  120,115,115
   40    C.....INSERT MUF MODE IF FREQUENCY IS ABOVE CIRCUIT MUF
   41      115 JH = MODMUF
   42          K = JMODE
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]INMOD.FOR;1
   38          IF(NHP(JFX).GT.0)RETURN
   39    C.....CHECK IF FREQUENCY IS ABOVE CIRCUIT MUF
   40          IF(FREQ - ALLMUF(IT) + EPS)  120,115,115
   41    C.....INSERT MUF MODE IF FREQUENCY IS ABOVE CIRCUIT MUF
   42      115 JH = MODMUF
   43          ncall=iflg+1
   44          K = JMODE
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]INMOD.FOR;1
   53           CALL RELBIL(IFX)
   54          RETURN
```

INMOD.FOR (cont'd.)

```
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]INMOD.FOR;1
   55          call allMODES(ncall,hop)
   56          RETURN
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]INMOD.FOR;1
   59          FV = FVMUF (JH)
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]INMOD.FOR;1
   61          ncall=iflg+2
   62          FV = FVMUF (JH)
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]INMOD.FOR;1
  123           CALL RELBIL(IFX)
  124    C.....RESET THE OLD MUF
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]INMOD.FOR;1
  126          call allMODES(ncall,hop)
  127    C.....RESET THE OLD MUF
************
                    Number of difference sections found: 8
                    Number of difference records  found: 30
```

INMUF.FOR

```
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]INMUF.FOR;1
   17          COMMON/RON/CLAT(5),CLONG(5),GLAT(5),RD(5),FI(3,5),YI(3,5),HI(3,5)
   18         A ,HPRIM(30,3),HTRUE(30,3),FVERT(30,3),KM,KFX,AFAC(30,3),HNOR(3)
   19         B ,FX(3,5),HTR(50),FNSQ(50)
   20          COMMON/TIME/ IT,GMT,UTIME(24),GMTR,XLMT(24)
   21          K = JMODE
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]INMUF.FOR;1
   17          COMMON /RON /CLAT(5), CLONG(5), GLAT(5), RD(5), FI(3,5), YI(3,5),
   18         1HI(3,5), HPRIM(30,5), HTRUE(30,5), FVERT(30,5),KM,KFX, AFAC(30,5),
   19         2HTR(50), FNSQ(50)
   20          COMMON / TIME / IT, GMT, UTIME(24), GMTR, XLMT(24), ITIM, JTX
   21          K = JMODE
************
                    Number of difference sections found: 1
                    Number of difference records  found: 4
```

IONCAP.FOR

```
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]IONCAP.FOR;1
   11    C  VERSION 85.04                RELEASE DATE JULY 4, 1985
   12    C
   13    C  N O T E IONCAP VERSION 85.04 IS EQUIVALENT TO IONCAP VERSION
   14    C  78.03 BUT HAS BEEN CONVERTED TO THE FORTRAN 77 STANDARD
   15    C
   16    C  VERSION 78.03                ORIGINALLY RELEASED MARCH 1, 1978
   17    C
   18    C  THIS NOTICE INDICATES THAT IONCAP WAS UPDATED OCTOBER 1, 1983
   19    C
   20    C*******************************************************************************
   21    C
   22    C  QUESTIONS CONCERNING THE IONCAP PROGRAM SHOULD BE DIRECTED TO
```

```
23   C
24   C     JOHN L. LLOYD                                          -OR-
25   C     LARRY R. TETERS      (303) 497-5410
26   C     U. S. DEPARTMENT OF COMMERCE
27   C     NATIONAL TELECOMMUNICATIONS AND INFORMATION ADMINISTRATION
28   C     INSTITUTE FOR TELECOMMUNICATION SCIENCES
29   C     325 BROADWAY
30   C     BOULDER, COLORADO  80303
31   C*************************************************************************
32   C
33   C  THE FOLLOWING REPORT DESCRIBES THE OPERATION AND USE OF IONCAP
34   C  (A COPY OF THIS REPORT IS PROVIDED WITH THE IONCAP PROGRAM,
35   C  ADDITIONAL COPIES MAY BE OBTAINED FROM THE NATIONAL TECHNICAL
36   C  INFORMATION SERVICE)
37   C
38   C     TETERS, L.R., J.L. LLOYD, G.W. HAYDON AND D.L. LUCAS (1983),
39   C     ESTIMATING THE PERFORMANCE OF TELECOMMUNICATIONS SYSTEMS
40   C     USING THE IONOSPHERIC TRANSMISSION CHANNEL IONOSPHERIC
41   C     COMMUNICATIONS ANALYSIS AND PREDICTION PROGRAM USER'S
42   C     MANUAL, NTIA REPORT 83-127, U.S. DEPARTMENT OF COMMERCE,
43   C     BOULDER, COLORADO 80303
44   C
45   C
46   C  THE FOLLOWING DOCUMENT DESCRIBES THE SIMULATION MODELS USED IN IONCAP
47   C  (A COPY OF THIS DOCUMENT IS PROVIDED WITH THE IONCAP PROGRAM)
48   C
49   C     LLOYD, J.L., D.L. LUCAS, G.W. HAYDON AND L.R. TETERS,
50   C     ESTIMATING THE PERFORMANCE OF TELECOMMUNICATIONS SYSTEMS
51   C     USING THE IONOSPHERIC TRANSMISSION CHANNEL TECHNIQUES
52   C     FOR ANALYZING IONOSPHERIC EFFECTS UPON HF SYSTEMS,
53   C     AN UNPUBLISHED DOCUMENT, U.S. DEPARTMENT OF COMMERCE,
54   C     BOULDER, COLORADO 80303
55   C
56   C*************************************************************************
57   C
58   C  THE TECHNIQUES USED IN THIS PROGRAM WERE INITIATED BY
59   C  C.C.I.R. REPORT 252-2, NEW DELHI, 1970,
60   C  "C.C.I.R. INTERIM METHOD FOR ESTIMATING SKY-WAVE FIELD STRENGTH AND
61   C  TRANSMISSION LOSS AT FREQUENCIES BETWEEN THE APPROXIMATE LIMITS OF
62   C  2 AND 30 MHZ" INTERNATIONAL TELECOMMUNICATIONS UNION, GENEVA, 1970.
63   C
64   C  ADDITIONAL INFORMATION CONCERNING TECHNIQUES FOR MODELING HF SYSTEMS
65   C  THAT DEPEND ON IONOSPHERIC PROPAGATION CAN BE FOUND IN THE FOLLOWING
66   C
67   C  NBS REPORT 7619 (1962)
68   C  ESSA TECHNICAL REPORT,IER-ITSA 1 (1966)
69   C  TECHNICAL REPORT  NO. RADC-TR-67-396 (1967)
70   C  ESSA TECHNICAL REPORT,ERL 110-ITS-78 (1969)
71   C  NRL MEMO REPORT 2226 (1971)
72   C  NRL MEMO REPORT 2500 (1972)
73   C
74   C  NO ATTEMPT HAS BEEN MADE IN THIS VERSION TO OPTIMIZE RUNNING TIME OR
75   C  STORAGE REQUIREMENT.
76   C  INPUT IS OF THREE KINDS
77   C  1. CARD IMAGES - THE INPUT IS FORMATTED CARD IMAGES READ
78   C       FROM FUNCTION MONITR AND ASSEMBLED IN SUBROUTINE DECRED USING
79   C       THE FORTRAN DECODE STATEMENT.
```

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C  2. LONG TERM DATA TAPE. THIS IS A BINARY TAPE CONTAINING COEFFICIENTS
C     FOR PREDICTING IONOSPHERIC INDICES. TWO BCD DATA TAPES AND DIRECT-
C     IONS FOR GENERATING THE BINARY TAPE ARE ADVAILABLE FROM ITS.
C  3. ANTENNA GAIN DATA. THE GAIN AS A FUNCTION OF FREQUENCY AND ANGLE
C     CAN BE READ FROM A FILE. THIS FILE CAN BE CALCULATED FROM THIS
C     PROGRAM
C
C***********************************************************************
C
C     THE IONCAP PROGRAM WAS INITIALLY DEVELOPED ON THE
C     U.S. DEPARTMENT OF COMMERCE - CDC 6600 COMPUTER
C     WITH THE KRONOS 2.1 OPERATING SYSTEM AND FORTRAN EXTENDED (FTN)
C     VERSION 4.  THE PROGRAM WAS CODED AS NEAR TO ANS FORTRAN AS WAS
C     POSSIBLE TO EASE THE ADAPTATION TO OTHER COMPUTER SYSTEMS.
C
C***********************************************************************
C
C  FILE DEFINITION OF LOGICAL UNITS USED BY IONCAP
C
C     LOGICAL UNIT      MNEMONIC              FILE DESCRIPTION
C
C       5 OR 15           LUI          USER DEFINED INPUT (CARD IMAGES)
C       6 OR 16           LUO          LINE PRINTER OUTPUT
C          2        *     LU2          IONOSPHERIC LONG TERM DATA BASE
C          5              LU5          PRIMARY USER DEFINED INPUT
C          6              LU6          PRIMARY LINE PRINTER OUTPUT
C         15              LU15         AUXILLARY USER DEFINED INPUT
C         16              LU16         AUXILLARY LINE PRINTER OUTPUT
C         20        *     LU20         COMMON/MUFS/ OUTPUT (METHOD 30)
C         25        *     LU25         ANTENNA PATTERN OUTPUT
C         26        *     LU26         OPTIONAL ANTENNA PATTERN INPUT
C         35              LU35         INPUT PROCEDURE (INTERNAL FILE)
C
C                    * DENOTES BINARY FILE, BCD OTHERWISE
C
C***********************************************************************
C
C  THERE ARE THREE BASIC PROGRAM ANALYSIS OPTIONS AVAILABLE TO THE USER
C     (A) MAXIMUM USABLE FREQUENCIES (MUF)
C     (B) LOWEST USEFUL HIGH FREQUENCIES (LUF)
C     (C) SYSTEM PERFORMANCE
C
C  THE PROGRAM ANALYSIS IS CONTROLLED BY A VARIABLE CALLED "METHOD"
C  WHICH IS INPUT BY THE USER. THE FOLLOWING METHODS ARE AVAILABLE
C
C  METHOD          DESCRIPTION OF METHOD
C
C     1        IONOSPHERIC PARAMETERS
C     2        IONOGRAMS
C     3        MUF-FOT LINES (NOMOGRAM)
C     4        MUF-FOT GRAPH
C     5        HPF-MUF-FOT GRAPH
C     6        MUF-FOT-ES GRAPH
C     7        FOT-MUF TABLE (FULL IONOSPHERE)
C     8        MUF-FOT GRAPH
C     9        HPF-MUF-FOT GRAPH
C    10        MUF-FOT-ANG GRAPH
C    11        MUF-FOT-ES GRAPH
```

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C     12        MUF BY MAGNETIC INDICES, K. (N O T E  NOT YET IMPLEMENTED)
C     13        TRANSMITTER ANTENNA PATTERN
C     14        RECEIVER ANTENNA PATTERN
C     15        BOTH TRANSMITTER AND RECEIVER ANTENNA PATTERNS
C     16        SYSTEM PERFORMANCE  (S.P.)
C     17        CONDENSED SYSTEM PERFORMANCE, RELIABILITY
C     18        CONDENSED SYSTEM PERFORMANCE, SERVICE PROBABILITY
C     19        PROPAGATION PATH GEOMETRY
C     20        COMPLETE SYSTEM PERFORMANCE (C.S.P.)
C     21        FORCED LONG PATH MODEL (C.S.P.)
C     22        FORCED SHORT PATH MODEL (C.S.P.)
C     23        USER SELECTED OUTPUT LINES (SET BY TOPLINES AND BOTLINES)
C     24        MUF-REL TABLE
C     25        ALL MODES TABLE
C     26        MUF-LUF-FOT TABLE (NOMOGRAM)
C     27        FOT-LUF GRAPH
C     28        MUF-FOT-LUF-GRAPH
C     29        MUF-LUF GRAPH
C     30        CREATE BINARY FILE OF VARIABLES IN "COMMON/MUFS/"
C               (ALLOWS THE USER TO SAVE MUFS-LUFS FOR PRINTING BY
C               A SEPARATE USER WRITTEN PROGRAM)
C*************************************************************************
C
C  THE USER SUPPLIED INPUT TO THE PROGRAM IS CARD IMAGES WHICH CONTAIN
C  A CARD "NAME IDENTIFIER" USED TO IDENTIFY THE INPUT PARAMETERS
C  THE FOLLOWING "NAME IDENTIFIERS" ARE IMPLEMENTED
C
C     IDENTIFIER              DESCRIPTION OF INPUT PARAMETERS
C
C     METHOD            PROGRAM RUN OPTION AND BEGINNING PAGE NUMBER
C     MONTH             YEAR AND A LIST OF UP TO 12 MONTHS
C     MONTHLOOP         YEAR AND MONTHS SPECIFIED IN A LOOP
C     SUNSPOT           LIST OF SUNSPOTS (ALL MONTHS ARE RUN FOR EACH)
C     CIRCUIT           TRANSMITTER-RECEIVER LOCATIONS
C     SYSTEM            POWER, NOISE, MIN.ANGLE, RELIAB, SNR, TIME DELAY
C     TIME              TIME OF DAY LOOP (AND INDICATOR FOR LMT OR UT)
C     ANTENNA           TRANSM OR RECEIVER, ANTENNA TYPE AND PARAMETERS
C     FREQUENCY         FREQUENCIES (THIS SET WILL INSERT FOT)
C     LABEL             ALPHANUMERIC LABEL FOR IDENTIFICATION
C     INTEGRATE         .GE. 0 FOR FAST INTEGRATION FOR E-F2 (NO F1)
C     EXECUTE           EXECUTE PROGRAM WITH PARAMETERS CURRENTLY SET
C     SAMPLE            GEOPHYSICAL SAMPLES (FOR A SPECIFIED AREA)
C     EFVAR             E, F1 AND F2 PARAMETERS (FOR A SPECIFIED AREA)
C     ESVAR             ES PARAMETERS (FOR A SPECIFIED AREA)
C     EDP               TRUE HEIGHTS AND ELECTRON DENSITY(FOR SPEC AREA)
C     AUXIN             READ INPUT CARD IMAGES FROM AN ALTERNATE FILE
C     AUXOUT            WRITE PROGRAM OUTPUT TO AN ALTERNATE FILE
C     ANTOUT            WRITE ANTENNA PATTERNS ON A FILE
C     OUTGRAPH          REQUEST OUTPUT OF SEVERAL METHODS
C     COMMENT           COMMENT CARD IN INPUT STREAM
C     FREEFORM          INPUT IS FREEFORM CARD IMAGES
C     PROCEDURE         DEFINITION OF AN INPUT PROCEDURE
C     END               TERMINATION OF AN INPUT PROCEDURE DEFINITION
C     NEXT              END OF MONTH/SUNSPOT LOOP
C     QUIT              TERMINATION OF PROGRAM EXECUTION
C     FPROB             CRITICAL FREQUENCY MULTIPLIERS
C     TOPLINES          USER SPECIFIED HEADING LINES (FOR METHOD 23)
```

```
  195   C     BOTLINES          USER SPECIFIED OUTPUT LINES (FOR METHOD 23)
  196   C     (USER DEFINED PROCEDURE NAME) REPLACE PROCEDURE NAME WITH ITS DEFN
  197   C*************************************************************************
  198   C WEIGHTS AND ABSCISSCAE FOR 40 POINT GUASSIAN SET BELOW.
  199         COMMON / DATR / WT(20), XT(20), NT, NPL, XNPL, TWDIV
  200   C  INPUT AND OUTPUT FILE NUMBERS
  201         COMMON / FILES / LUI, LUO, LU2, LU5, LU6, LU15, LU16, LU20, LU25,
  202        A LU26, LU35, LU61
  203   C NUMERICAL MAP COEFICENTS, SEE REDMAP.
  204   C     COMMON / ONE / IA(6), IB(6), IKIM(10,6), COFION(2604)
  205         COMMON / ONE / IA(6), IB(6), IKIM(10,6), ESLCOF(5,55), ESMCOF(7
  206        1, 61), ESUCOF (5, 55), F2COF (13, 76), FM3COF (9, 49), ERCOF (9, 2
  207        2 2), XF1COF(10,7), XPMAP(29,16,2), ABMAP(2,3)
  208   C MORE COEFICENTS AND TABLES, SEE REDMAP
  209         COMMON / TWO / F2D(16,6,6), P(29,16,8), ABP(2,8), DUD(5,12,5),
  210        A FAM(14,12), SYS(9,16,6), PERR(9,4,6), AB(318)
  211   C
  212   C SET PREDEFINED CONSTANTS.
  213   C
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]IONCAP.FOR;1
   11   D     INCLUDE 'IONCAP.DOC/LIST'              ! 3 additional PAGEs of INFO
   12   C
   13   C WEIGHTS AND ABSCISSCAE FOR 40 POINT GUASSIAN SET BELOW:
   14         COMMON / DATR /  WT(20), XT(20), NT, NPL, XNPL, TWDIV
   15   C  INPUT AND OUTPUT FILE NUMBERS
   16         COMMON / FILES / LUI, LUO, LU2, LU5, LU6, LU15, LU16,
   17        1                 LU20, LU25, LU26, LU35, LU61
   18   C NUMERICAL MAP COEFICENTS (SEE REDMAP):
   19   C     COMMON / ONE /   IA(6), IB(6), IKIM(10,6), COFION(2604)
   20         COMMON / ONE /   IA(6), IB(6), IKIM(10,6), ESLCOF(5,55),
   21        1                 ESMCOF(7,61), ESUCOF(5,55), F2COF(13,76),
   22        2                 FM3COF(9,49), ERCOF(9,22), XF1COF(10,7),
   23        3                 XPMAP(29,16,2), ABMAP(2,3)
   24   C MORE COEFICENTS AND TABLES (SEE REDMAP):
   25         COMMON / TWO /   F2D(16,6,6), P(29,16,8), ABP(2,8), DUD(5,12,5),
   26        1                 FAM(14,12), SYS(9,16,6), PERR(9,4,6), AB(318)
   27   C
   28   C SET PREDEFINED CONSTANTS:
   29   C
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]IONCAP.FOR;1
  216         DATA IIA / 1,276,703,978,1966,2407/
  217         DATA IIB / 5, 7, 5, 13, 9, 9/
  218   C
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]IONCAP.FOR;1
   32         DATA IIA / 1,276,703,978,1966,2407 /
   33         DATA IIB / 5, 7, 5, 13, 9, 9 /
   34   C
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]IONCAP.FOR;1
  229   C.....REWIND INPUT LOGICAL UNITS BEFORE EXECUTION
  230         REWIND LU2
```

IONCAP.FOR (cont'd.)

```
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]IONCAP.FOR;1
   45   C.....REWIND INPUT LOGICAL UNITS BEFORE EXECUTION:
   46         REWIND LU2
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]IONCAP.FOR;1
  235         END
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]IONCAP.FOR;1
   51         CLOSE(UNIT=LU2)
   52         CLOSE(UNIT=LU26)
   53         END
************
                  Number of difference sections found: 4
                  Number of difference records  found: 207
```

IONPLT.FOR

```
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]IONPLT.FOR;1
   11         COMMON /TIME /IT, GMT, UTIME (24)
   12         COMMON / MFAC /F2M3(5),HPF2(5),ZENANG(5),ZENMAX(5),IEDP,FSECV(3)
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]IONPLT.FOR;1
   11         COMMON / TIME / IT, GMT, UTIME(24), GMTR, XLMT(24), ITIM, JTX
   12         COMMON / MFAC /F2M3(5),HPF2(5),ZENANG(5),ZENMAX(5),IEDP,FSECV(3)
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]IONPLT.FOR;1
   16         COMMON /DON /ALATD, AMIN, AMIND, BTR, BTRD, DLONG, DMP, ERTR, GLD,
   17        1 GCDKM, PMP, PWR, RLAT, RLATD, RLONG, RLONGD, RSN, SIGTR, TLAT, TL
   18        2ATD, TLONG, TLONGD, BRTD, FLUX, SSN, ATMNO
   19         COMMON / ION / IANT(3,2), NTR(2), IEA, IFQB, IFQE, IGRAPH, IHRE,
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]IONPLT.FOR;1
   16         COMMON /DON /ALATD, AMIN, AMIND, BTR, BTRD, DLONG, DMP, ERTR, GCD,
   17        1 GCDKM, PMP, PWR, RLAT, RLATD, RLONG, RLONGD, RSN, SIGTR, TLAT,
   18        2 TLATD,TLONG,TLONGD,BRTD,FLUX,SSN,D90R,D50R,D10R,D90S,D50S,D10S
   19         COMMON / ION / IANT(3,2), NTR(2), IEA, IFQB, IFQE, IGRAPH, IHRE,
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]IONPLT.FOR;1
   22         COMMON /RON /CLAT (5), CLONG (5), GLAT (5), RD (5), FI (3, 5), YI
   23        1(3, 5), HI (3, 5), HPRIM (30, 3), HTRUE (30, 3), FVERT (30, 3), KM
   24        2, KFX, AFAC (30, 3), HNOR (3)
   25         COMMON / SSP / SUN(2,12), MONTH
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]IONPLT.FOR;1
   22         COMMON /RON /CLAT(5), CLONG(5), GLAT(5), RD(5), FI(3,5), YI(3,5),
   23        1HI(3,5), HPRIM(30,5), HTRUE(30,5), FVERT(30,5),KM,KFX, AFAC(30,5),
   24        2HTR(50), FNSQ(50)
   25         COMMON / SSP / SUN(2,12), MONTH
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]IONPLT.FOR;1
  147      500 FORMAT(' ',14X,10(I2,8X))
  148      501 FORMAT(' ',14X,9(I2,8X),I2,7X,'FVERT',3X,'HTRUE',3X,'HPRIM')
  149      502 FORMAT(' ',5X,20('+----'))
  150      504 FORMAT(' ',1X,A3,1X,A1,100A1,A1)
```

```
  151      505 FORMAT(' ',1X,A3,1X,A1,100A1,A1,I3,3F8.2)
  152      506 FORMAT(' ',1X,A3,1X,A1,1X,A3,F5.2,1X,F5.1,1X,F5.1,1X,78A1,A1,I3,
  153         1 3F8.2)
  154      520 FORMAT('1')
  155      522 FORMAT(' ',20X,'VIRTUAL HEIGHT - REFLECTION HEIGHT VS. SOUNDING',
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]IONPLT.FOR;1
  147      500 FORMAT(' ',12X,10(I2,8X))
  148      501 FORMAT(' ',12X,9(I2,8X),I2,6X,'FVERT',3X,'HTRUE',3X,'HPRIM')
  149      502 FORMAT(' ',3X,20('+----'))
  150      504 FORMAT(' ',A3,A1,100A1,A1)
  151      505 FORMAT(' ',A3,A1,100A1,A1,I3,F7.2,2F8.2)
  152      506 FORMAT(' ',A3,A1,1X,A3,F5.2,1X,F5.1,1X,F5.1,1X,78A1,A1,I3,
  153         1 F7.2,2F8.2)
  154      520 FORMAT(1H1)
  155      522 FORMAT(' ',20X,'VIRTUAL HEIGHT - REFLECTION HEIGHT VS. SOUNDING',
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]IONPLT.FOR;1
  161      528 FORMAT(' ',1X,A3,1X,A1,1X,A3,3(F5.2,1X),F5.1,1X,72A1,
  162         A A1,I3,3F8.2)
  163          END
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]IONPLT.FOR;1
  161      528 FORMAT(' ',A3,A1,1X,A3,3(F5.2,1X),F5.1,1X,72A1,
  162         A A1,I3,F7.2,2F8.2)
  163          END
************
                    Number of difference sections found: 5
                    Number of difference records  found: 17
```

IONSET.FOR

```
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]IONSET.FOR;1
    9          COMMON /RON /CLAT (5), CLONG (5), GLAT (5), RD (5), FI (3, 5), YI
   10         1(3, 5), HI (3, 5), HPRIM (30, 3), HTRUE (30, 3), FVERT (30, 3), KM
   11         2, KFX
   12          IF (KM - 1)105, 105, 110
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]IONSET.FOR;1
    9          COMMON /RON /CLAT(5), CLONG(5), GLAT(5), RD(5), FI(3,5), YI(3,5),
   10         1HI(3,5), HPRIM(30,5), HTRUE(30,5), FVERT(30,5),KM,KFX, AFAC(30,5),
   11         2HTR(50), FNSQ(50)
   12          IF (KM - 1)105, 105, 110
************
                    Number of difference sections found: 1
                    Number of difference records  found: 3
```

LECDEN.FOR

```
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]LECDEN.FOR;1
   13         C NUMNAM, NUPROC, MAXMET
   14          COMMON /DON /ALATD, AMIN, AMIND, BTR, BTRD, DLONG, DMP, ERTR, GLD,
   15         1 GCDKM, PMP, PWR, RLAT, RLATD, RLONG, RLONGD, RSN, SIGTR, TLAT, TL
   16         2ATD, TLONG, TLONGD
   17          COMMON /RON /CLAT (5), CLONG (5), GLAT (5), RD (5), FI (3, 5), YI
   18         1(3, 5), HI (3, 5), HPRIM (30, 3), HTRUE (30, 3), FVERT (30, 3), KM
   19         2 , KFX, AFAC(30,3), HNOR(3), FX(3,5), HTR(50), FNSQ(50)
```

LECDEN.FOR (cont'd.)

```
   20   C.....RETURN IF EXTERNAL ELECTRON DENSITY PROFILE IS USED
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]LECDEN.FOR;1
   13         C NUMNAM, NUPROC, MAXMET, mspec, m100
   14          COMMON /DON /ALATD, AMIN, AMIND, BTR, BTRD, DLONG, DMP, ERTR, GCD,
   15         1 GCDKM, PMP, PWR, RLAT, RLATD, RLONG, RLONGD, RSN, SIGTR, TLAT,
   16         2 TLATD,TLONG,TLONGD,BRTD,FLUX,SSN,D90R,D50R,D10R,D90S,D50S,D10S
   17          COMMON /RON /CLAT(5), CLONG(5), GLAT(5), RD(5), FI(3,5), YI(3,5),
   18         1HI(3,5), HPRIM(30,5), HTRUE(30,5), FVERT(30,5),KM,KFX, AFAC(30,5),
   19         2HTR(50), FNSQ(50)
   20   C.....RETURN IF EXTERNAL ELECTRON DENSITY PROFILE IS USED
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]LECDEN.FOR;1
   64          HB1 = HI(2,K) - YI(2,K)
   65          IF(HB2 - HB1) 110, 110, 126
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]LECDEN.FOR;1
   64          HB1 = HI(2,K) - YI(2,K)+.00001
   65          IF(HB2 - HB1) 110, 110, 126
************
                    Number of difference sections found: 2
                    Number of difference records  found: 8
```

LISTIN.FOR

```
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]LISTIN.FOR;1
    7         C NUMNAM, NUPROC, MAXMET
    8          COMMON / METSET / VERSN, ITRUN, ITOUT, JTRUN(40), JTOUT(40)
    9          COMMON / FILES / LUI, LUO, LU2, LU5, LU6, LU15, LU16, LU20, LU25,
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]LISTIN.FOR;1
    7         C NUMNAM, NUPROC, MAXMET, mspec, m100
    8          COMMON / METSET / VERSN, ITRUN, ITOUT, JTRUN(40), JTOUT(40), LSEAS
    9          COMMON / FILES / LUI, LUO, LU2, LU5, LU6, LU15, LU16, LU20, LU25,
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]LISTIN.FOR;1
  119     1500 FORMAT('1','IONOSPHERIC COMMUNICATIONS ANALYSIS AND PREDICTION ',
  120         A 'PROGRAM - IONCAP   VERSION ',F5.2,//)
  121     1502 FORMAT(' ',8(9X,I1),/,' ',8('1234567890'),/)
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]LISTIN.FOR;1
  119     1500 FORMAT(1H1,' IONOSPHERIC COMMUNICATIONS ANALYSIS AND PREDICTI',
  120         A 'ON PROGRAM - IONCAP   VERSION ',F5.2,//)
  121     1502 FORMAT(' ',8(9X,I1),/,' ',8('1234567890'),/)
************
                    Number of difference sections found: 2
                    Number of difference records  found: 4
```

LNGOUT.FOR

```
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]LNGOUT.FOR;1
    3          COMMON/DON/ALATD,AMIN,AMIND,BTR,BTRD,DLONG,DMP,ERTR,GCD,GCDKM,PMP
    4         A ,PWR,RLAT,RLATD,RLONG,RLONGD,RSN,SIGTR,TLAT,TLATD,TLONG,TLONGD
    5         B ,BRTR,FLUX,SSN,ATMNO
    6          COMMON/FRQ/FREL(29),FREQ
    7          COMMON/LOSX/ANDVX(45,3),ADVX(45,3),AOFX(45,3),ARFX(45,3),GRLOSX(45
```

```
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]LNGOUT.FOR;1
     3          COMMON /DON /ALATD, AMIN, AMIND, BTR, BTRD, DLONG, DMP, ERTR, GCD,
     4         1 GCDKM, PMP, PWR, RLAT, RLATD, RLONG, RLONGD, RSN, SIGTR, TLAT,
     5         2 TLATD,TLONG,TLONGD,BRTD,FLUX,SSN,D90R,D50R,D10R,D90S,D50S,D10S
     6          COMMON / FRQ / FREL(29), FREQ, JMODE
     7          COMMON/LOSX/ANDVX(45,3),ADVX(45,3),AOFX(45,3),ARFX(45,3),GRLOSX(45
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]LNGOUT.FOR;1
    10          COMMON / RAYS / ANG(40), IFOB(40,30,3), NANG
    11          COMMON/REFLX/DELFX(45,3),HPFLX(45,3),HTFLX(45,3),GDFLX(45,3),FVFLX
    12         A  (45,3)
    13          COMMON/TIME/IT,GMT,UTIME(24)
    14          COMMON /ZON/ ABPS(7),CREL(7),EFF(7),FLDST(7),GRLOS(7),HN(7),HP(7)
    15         A ,PROB(7),RELY(7),RGAIN(7),SIGPOW(7),SN(7),SPRO(7),TGAIN(7),TIMED
    16         B (7),TLOSS(7),B(7),FSLOS(7),ADV(7),OBF(7),NMODE(7)
    17          CHARACTER NNAME(12)*10
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]LNGOUT.FOR;1
    10          COMMON / RAYS / ANG(40), IFOB(40,30,5), NANG
    11          COMMON/REFLX/DELFX(45,3),HPFLX(45,3),HTFLX(45,3),GDFLX(45,3),FVFLX
    12         A  (45,3)
    13          COMMON / TIME / IT, GMT, UTIME(24), GMTR, XLMT(24), ITIM, JTX
    14          COMMON / ZON / ABPS(7), CREL(7), EFF(7), FLDST(7), GRLOS(7),
    15         1 HN(7), HP(7), PROB(7), RELY(7), RGAIN(7), SIGPOW(7), SN(7),
    16         2 SPRO(7), TGAIN(7), TIMED(7), TLOSS(7), B(7), FSLOS(7), ADV(7),
    17         3 OBF(7),NMODE(7),TLLOW(7),TLHGH(7)
    18          CHARACTER NNAME(12)*10
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]LNGOUT.FOR;1
    21          XLMT = GMT
    22          DEND = AMIN1(GCDKM,4000.)
    23          CNGDAY = CNGTIM( XLMT, TLONG*R2D, 1)
    24          DO 125 IA=1,NANG
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]LNGOUT.FOR;1
    22          XTIM = GMT
    23          DEND = AMIN1(GCDKM,4000.)
    24          CNGDAY = CNGTIM( XTIM, TLONG*R2D, 1)
    25          DO 125 IA=1,NANG
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]LNGOUT.FOR;1
    51      502 FORMAT('1',1X,'FREQ;',F5.2,'  UT; ',F5.2,'  LMT;',F5.2,'  DIST;',
    52         A F7.1,' KM  ',A3,' SSN; ',F5.1)
    53      506 FORMAT(' ',1X,F4.1,2X,F6.1,2X,F4.1,1X,F6.1,1X,F6.1,2X,F6.1,1X,
    54         A F6.1,1X,F6.1,2X,F5.1,2X,F5.1,2X,F4.1,2X,F10.4,2X,F10.4)
    55      510 FORMAT('0','TANG ',F4.1,' TMODE ',A2,' TPROB ',F6.2,
    56         A ' RPROB ',F6.2,' RMODE ',A2,' RANG ',F4.1)
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]LNGOUT.FOR;1
    52      502 FORMAT(1H1,1X,'FREQ;',F5.2,'  UT; ',F5.2,'  LMT;',F5.2,'  DI',
    53         A 'ST;',F7.1,' KM  ',A3,' SSN; ',F5.1)
    54      506 FORMAT(' ',1X,F4.1,2X,F6.1,2X,F4.1,1X,F6.1,1X,F6.1,2X,F6.1,1X,
    55         A F6.1,1X,F6.1,2X,F5.1,2X,F5.1,2X,F4.1,2X,F10.4,2X,F10.4)
    56      510 FORMAT(/,/,'TANG ',F4.1,' TMODE ',A2,' TPROB ',F6.2,
    57         A ' RPROB ',F6.2,' RMODE ',A2,' RANG ',F4.1)
```

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************
                    Number of difference sections found: 4
                    Number of difference records  found: 20
```

LNGPAT.FOR

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************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]LNGPAT.FOR;1
     5          COMMON/ANOIS/ATNU,ATNY,CC,TM,XEFF,RCNSE,DU,DL,SIGM,SXGU,SXGL,KJ,JK
     6          COMMON/MUFS/EMUF(24),F1MUF(24),F2MUF(24),ESMUF(24),ALLMUF(24),FOT
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]LNGPAT.FOR;1
     5          COMMON/ANOIS/ATNU,ATNY,CC,TM,RCNSE,DU,DL,SIGM,SxGU,SxGL,KJ,JK
     6          COMMON/MUFS/EMUF(24),F1MUF(24),F2MUF(24),ESMUF(24),ALLMUF(24),FOT
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]LNGPAT.FOR;1
    11          COMMON/DON/ALATD,AMIN,AMIND,BTR,BTRD,DLONG,DMP,ERTR,GCD,GCDKM,PMP
    12         A ,PWR,ARAT,RLATD,RLONG,RLONGD,RSN,SIGTR,TLAT,TLATD,TLONG,TLONGD,
    13         A  BRTD,FLUX,SSN,ATMNO
    14          COMMON/LPATH/ GCDLNG,TGML(45),RGML(45),DELOPT,GMIN,YMIN,LTGM,LRGM
    15          COMMON/FRQ/FREL(29),FREQ
    16          COMMON / RON / CLAT(5), CLONG(5), GLAT(5), RD(5), FI(3,5), YI(3,5)
    17         1 , HI(3,5), HPRIM(30,3), HTRUE(30,3), FVERT(30,3), KM, KFX,
    18         2 AFAC(30,3), HNOR(3), FX(3,5), HTR(50), FNSQ(50)
    19          COMMON/LOSX/ANDVX(45,3),ADVX(45,3),AOFX(45,3),ARFX(45,3),GRLOSX(45
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]LNGPAT.FOR;1
    11          COMMON /DON /ALATD, AMIN, AMIND, BTR, BTRD, DLONG, DMP, ERTR, GCD,
    12         1 GCDKM, PMP, PWR, RLAT, RLATD, RLONG, RLONGD, RSN, SIGTR, TLAT,
    13         2 TLATD,TLONG,TLONGD,BRTD,FLUX,SSN,D90R,D50R,D10R,D90S,D50S,D10S
    14          COMMON / FRQ / FREL(29), FREQ, JMODE
    15          COMMON /RON /CLAT(5), CLONG(5), GLAT(5), RD(5), FI(3,5), YI(3,5),
    16         1HI(3,5), HPRIM(30,5), HTRUE(30,5), FVERT(30,5),KM,KFX, AFAC(30,5),
    17         2HTR(50), FNSQ(50)
    18          COMMON/LOSX/ANDVX(45,3),ADVX(45,3),AOFX(45,3),ARFX(45,3),GRLOSX(45
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]LNGPAT.FOR;1
    23         B ,ISKP(3),IMODE(45,3),AFFLX(45,3),DELPEN(3,3)
    24          COMMON/SIGD/DSL,ASM,DSU,AGLAT,DSLF,ASMF,DSUF,ACAV,FEAV,AFE,BFE,HNU
    25         A ,HTLOSS,XNUZ,XVE
    26          COMMON/TON/ADJ,ADS,ATMO,GNOS,GOT,PWRDB,ZCNSE,REL,SL,SLS,SPR,SU,SUS
    27         A ,TIMER,XADJN,ZEFF,XNOISE,XTLOS,ZNOISE,NF
    28          COMMON /ZON/ ABPS(7),CREL(7),EFF(7),FLDST(7),GRLOS(7),HN(7),HP(7),
    29         A PROB(7),RELY(7),RGAIN(7),SIGPOW(7),SN(7),SPRO(7),TGAIN(7),TIMED
    30         B (7),TLOSS(7),B(7),FSLOS(7),ADV(7),OBF(7),NMODE(7)
    31         C , NPROB,NREL,TLLOW(7),TLHGH(7)
    32    C.....LTGM .GE. 1 AND LRGM .GE. 1 SINCE OVER-THE-MUF ADDED
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]LNGPAT.FOR;1
    22         B ,ISKP(3),IMODE(45,3),AFFLX(45,3),DELPEN(3,5)
    23          COMMON/SIGD/DSL,ASM,DSU,AGLAT,DSLF,ASMF,DSUF,ACAV,FEAV,AFE,BFE,HNU
    24         A ,HTLOSS,XNUZ,XVE
    25          COMMON/TON/ADJ,ADS,GNOS,GOT,PWRDB,REL,SL,SLS,SPR,SU,SUS
    26         A ,XNOISE,ZNOISE,NF
    27          COMMON / ZON / ABPS(7), CREL(7), EFF(7), FLDST(7), GRLOS(7),
    28         1 HN(7), HP(7), PROB(7), RELY(7), RGAIN(7), SIGPOW(7), SN(7),
    29         2 SPRO(7), TGAIN(7), TIMED(7), TLOSS(7), B(7), FSLOS(7), ADV(7),
    30         3 OBF(7),NMODE(7),TLLOW(7),TLHGH(7)
```

```
   31   C.....LTGM .GE. 1 AND LRGM .GE. 1 SINCE OVER-THE-MUF ADDED
************
                    Number of difference sections found: 3
                    Number of difference records  found: 18
```

LUFFY.FOR

```
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]LUFFY.FOR;1
    1          SUBROUTINE LUFFY
    2   C
    3   C      SHORT PATH SYSTEM PERFORMANCE
    4   C
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]LUFFY.FOR;1
    1          SUBROUTINE LUFFY(IPFLAG)
    2   C
    3   C      LONG AND SHORT PATH SYSTEM PERFORMANCE AND LUFS.
    4   C
    5   C           IPFG        FUNCTION
    6   C           ----        ------------------------------
    7   C            100        SHORT PATH SYSTEM PERFORMANCE
    8   C            200        LONG PATH SYSTEM PERFORMANCE
    9   C            300        SHORT PATH LUF
   10   C            400        LONG PATH LUF
   11   C
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]LUFFY.FOR;1
   10         C NUMNAM, NUPROC, MAXMET
   11          COMMON / OUTPRT / LINBOT(30), LINBD(14), LINTOP(15), LINTP(14),
   12         A GRPTYP, JOUT, LINBYP, LINES, LINMAX, LINTYP, LPAGES, NLINE
   13          COMMON / RAYS / ANG(40), IFOB(40,30,3), NANG
   14          COMMON / SON / ANGLE(13), ANGLER(13), CPROB(13), DBLOS(13),
   15         A DBLOSL(13), DBLOSU(13), DBU(13), DELAY(13), NDBW(13), NHP(13),
   16         B NYNOIS(13), PROBMP(13), RELIAB(13), SNDB(13), SNPR(13),
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]LUFFY.FOR;1
   17         C NUMNAM, NUPROC, MAXMET, mspec, m100
   18          COMMON / OUTLAB / LABEL(11), LAYTYP(5), IEAST, INORTH, ISOUTH,
   19         A IWEST, LABLI, LABLJ, LABLK
   20          COMMON / OUTPRT / LINBOT(30), LINBD(14), LINTOP(15), LINTP(14),
   21         A GRPTYP, JOUT, LINBYP, LINES, LINMAX, LINTYP, LPAGES, NLINE
   22          COMMON / RAYS / ANG(40), IFOB(40,30,5), NANG
   23          COMMON / SON / ANGLE(13), ANGLER(13), CPROB(13), DBLOS(13),
   24         A DBLOSL(13), DBLOSU(13), DBU(13), DELAY(13), DBW(13), NHP(13),
   25         B NYNOIS(13), PROBMP(13), RELIAB(13), SNDB(13), SNPR(13),
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]LUFFY.FOR;1
   31         1 GCDKM, PMP, PWR, RLAT, RLATD, RLONG, RLONGD, RSN, SIGTR, TLAT, TL
   32         2ATD, TLONG, TLONGD
   33          COMMON /RON /CLAT (5), CLONG (5), GLAT (5), RD (5), FI (3, 5), YI
   34         1(3, 5), HI (3, 5), HPRIM (30, 3), HTRUE (30, 3), FVERT (30, 3), KM
   35         2, KFX, AFAC (30, 3), HNOR (3)
   36          COMMON /RTANT /XETA, XSIG, XEPS, XND, XNL, XNH, TEX (4), ITANT, IR
   37         1 ANT, RETA, RSIG, REPS, RND, RNL, RNH, REX(4), TEFF, REFF, KASANT
   38          COMMON / ZON / ABPS(7), CREL(7), EFF(7), FLDST(7), GRLOS(7),
   39         1HN (7), HP (7), PROB (7), RELY (7), RGAIN (7), SIGPOW (7), SN (7),
```

```
   40         2 SPRO (7), TGAIN (7), TIMED (7), TLOSS (7), B (7), FSLOS (7), ADV
   41         C (7),OBF(7),NMODE(7),NPROB,NREL,TLLOW(7),TLHGH(7)
   42          COMMON /TON /ADJ, ADS, ATMO, GNOS, GOT, PWRDB, RCNSE, REL, SL, SLS
   43         1, SPR, SU, SUS, TIMER, XADJN, XEFF, XNOISE, XTLOS, ZNOISE, NF
   44          COMMON / FRQ / FREL(29), FREQ, JMODE
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]LUFFY.FOR;1
   40         1 GCDKM, PMP, PWR, RLAT, RLATD, RLONG, RLONGD, RSN, SIGTR, TLAT,
   41         2 TLATD,TLONG,TLONGD,BRTD,FLUX,SSN,D90R,D50R,D10R,D90S,D50S,D10S
   42          COMMON /RON /CLAT(5), CLONG(5), GLAT(5), RD(5), FI(3,5), YI(3,5),
   43         1HI(3,5), HPRIM(30,5), HTRUE(30,5), FVERT(30,5),KM,KFX, AFAC(30,5),
   44         2HTR(50), FNSQ(50)
   45          COMMON /RTANT /XETA, XSIG, XEPS, XND, XNL, XNH, TEX (4), ITANT, IR
   46         1 ANT, RETA, RSIG, REPS, RND, RNL, RNH, REX(4), TEFF, REFF, KASANT
   47          COMMON /1ON /ADJ, ADS, GNOS, GOT, PWRDB, REL, SL, SLS
   48         1, SPR, SU, SUS, XNOISE,ZNOISE,NF
   49          COMMON / FRQ / FREL(29), FREQ, JMODE
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]LUFFY.FOR;1
   53          COMMON /TIME /IT, GMT, UTIME (24)
   54    C.....TEMPORARY STORAGE
   55          DIMENSION XANG(3), XCPB(3), XDBL(3), XDBU(3), XDELY(3), XPMP(3),
   56         A XREL(3), XSN(3), XSPB(3), XVHI(3), LMOD(3), LNDB(3), LNHP(3),
   57         B LNOIS(3), XSNP(3), XREFF(3)
   58          DIMENSION XDBLL(3),XDBLU(3), XTGA(3),XRGA(3),XFSL(3),XABS(3),
   59         A XOBF(3), XADL(3), XGRD(3)
   60          CHARACTER ISTAR*2
   61          CHARACTER MODE*2, MODER*2, MODVHF*2
   62          CHARACTER IMON*3, IRCVR*10, ITRAN*10, IRLAT*1, IRLONG*1, ITLAT*1,
   63         A ITLONG*1, NYEAR*5
   64          DATA ISTAR/' N'/
   65    C.....SET FLAG IN INDICATE SHORT PATH MODEL
   66          JLONG = -1
   67    C.....REDUCE ANGLE SCAN FOR THIS DISTANCE
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]LUFFY.FOR;1
   58          COMMON / ION / IANT(3,2), NTR(2), IEA, IFQB, IFQE, IGRAPH, IHRE,
   59         A IHRO, IHRS, JO, LUFP, METHOD, MONPR, NDAY, NES, NOISE, NPAT,
   60         B NPSL, NRSP, NUMO
   61          COMMON / allMODE /ABPS(20),CREL(20),FLDST(20),HN(20),HP(20),
   62         1PROB(20),RELY(20),RGAIN(20),SIGPOW(20),SN(20),
   63         2SPRO(20),TGAIN(20),TIMED(20),TLOSS(20),B(20),FSLOS(20),
   64         CNMODE(20),TLLOW(20),TLHGH(20),EFF(20),NREL,NMMOD
   65          COMMON / TIME / IT, GMT, UTIME(24), GMTR, XLMT(24), ITIM, JTX
   66          common/indicez/ispot,iseaz,ifqn,iour,inmmd(11,24,4,2)
   67    C.....TEMPORARY STORAGE
   68          DIMENSION FREA(13)
   69          CHARACTER ISTAR*2
   70          CHARACTER MODE*2, MODER*2, MODVHF*2, LAYTYP*2
   71          CHARACTER IMON*3, IRCVR*10, ITRAN*10, IRLAT*1, IRLONG*1, ITLAT*1,
   72         A ITLONG*1, NYEAR*5
   73          CHARACTER  LABEL*5, IEAST*1, INORTH*1, ISOUTH*1, IWEST*1, LABLI*5,
   74         A LABLJ*5, LABLK*5
   75          IPFG=IPFLAG
   76          IF(IPFG.LT.300)THEN
   77            IF(IPFG.EQ.100)THEN
```

```
   78   C.........SET FLAG TO INDICATE SHORT PATH MODEL
   79              JLONG = -1
   80              ISTAR=' N'
   81            ELSE
   82   C.........SET FLAG TO INDICATE LONG PATH MODEL
   83              JLONG = 1
   84              ISTAR='* '
   85            ENDIF
   86
   87          ELSE
   88            PLUF = LUFP
   89   C.......REQUIRED RELIABILITY
   90            PLUF = .01 * PLUF
   91          ENDIF
   92   C.....REDUCE ANGLE SCAN FOR THIS DISTANCE
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]LUFFY.FOR;1
   71          K = JMODE
   72   C.....ELECTRON DENSITY PROFILE
   73          CALL LECDEN(K)
   74   C.....IONOGRAM
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]LUFFY.FOR;1
   96          IF((IPFG.EQ.100).OR.(IPFG.EQ.300))THEN
   97   C.......SELECT SHORT PATH AREA
   98            K = JMODE
   99          ELSE
  100   C.......SELECT LONG PATH TRANSMITTER AREA
  101            K=1
  102          ENDIF
  103   C.....ELECTRON DENSITY PROFILE
  104   84     CALL LECDEN(K)
  105   C.....IONOGRAM
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]LUFFY.FOR;1
   80   C.....SET ABSORPTION LOSS PARAMETERS, ADJUST SIGNAL DISTRIBUTION TABLES
   81          CALL SIGDIS
   82   C  GET NOISE VALUE AT 1 MHZ  FOR RCVR SITE
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]LUFFY.FOR;1
  111          IF((IPFG.EQ.100).OR.(K.GT.1))GO TO 87
  112   C.....CAN RUN FOR SHORT PATHS ALSO
  113   C.....SO SET ALL SAMPLE AREAS
  114          CALL SETLNG
  115   C.....FIND LONG PATH RECEIVER INDEX
  116          IF(KFX.EQ.2)THEN
  117            K=2
  118          ELSE IF(KFX.GT.2)THEN
  119            K=3
  120          ELSE
  121            GO TO 87
  122          ENDIF
  123          GO TO 84
  124   C.....SET ABSORPTION LOSS PARAMETERS, ADJUST SIGNAL DISTRIBUTION TABLES
  125   87     CALL SIGDIS
  126   C  GET NOISE VALUE AT 1 MHZ  FOR RCVR SITE
```

```
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]LUFFY.FOR;1
   85          DO 265 IF=1,13
   86    C.....START OF PRESET OF COMMON/ZON/
   87          IFX = IF
   88          ANGLE (IF) = -1.0
   89          ANGLER(IF) = -1.0
   90          CPROB (IF) = 0.0
   91          DBLOS (IF) = 1000.
   92          DBLOSL(IF) = 10.
   93          DBLOSU(IF) = 10.
   94          DBU   (IF) = -1000.
   95          DELAY (IF) = -1.
   96          PROBMP (IF) = 0.0
   97          RELIAB(IF) = 0.0
   98          SNDB  (IF) = -1000.
   99          SPROB (IF) = 0.0
  100          VHIGH (IF) = -1.
  101          MODE(IF) = ISTAR
  102          MODER(IF) = ISTAR
  103          NDBW  (IF) = -1000.
  104          NHP   (IF) = -1.
  105          NYNOIS  (IF) = 1000.
  106          VDBU(IF) = -1000.
  107          VLLOW(IF) = 10.
  108          VLUP(IF) = 10.
  109          MODVHF(IF) = ISTAR
  110          SNPR(IF) = 1000.
  111    C.....END OF PRESET OF COMMON/ZON/
  112          IF (IF -13) 116,270,270
  113    C.....FREQUENCY COMPLEMENT MAY NOT BE FULL
  114      116 IF (FREL(IF) ) 265,265,120
  115      120 FREQ = FREL(IF)
  116          K = JMODE
  117    C.....RAY SET TABLE
  118          CALL FINDF(K)
  119    C.....NOISE DISTRIBUTION
  120          CALL GENOIS
  121          IF( DMAXKM(K) ) 122,122,123
  122    C.....ONLY ONE OVER THE MUF MODE
  123      122 IHSRT = NHOPMF(MODMUF)
  124          IHSTP = IHSRT
  125          GO TO 124
  126    C.....UP TO THREE HOPS
  127      123 IHSRT = GCDKM/DMAXKM(K) + 1.
  128          IHSTP = GCDKM/DSKPKM(K)
  129          IHSTP = MAX0(IHSTP,IHSRT)
  130          IHSTP =MIN0(IHSTP,IHSRT+2)
  131      124 IXHP = 0
  132    C.....HOP LOOP
  133          DO 262 IHOP = IHSRT, IHSTP
  134          IXHP = IXHP + 1
  135          HOP = IHOP
  136    C.....HOP DISTANCE
  137          GHOP = GCD/HOP
  138    C.....FIND UP TO SIX MODES
  139          CALL REGMOD
```

```
C.....FIND THE MOST RELIABLE
      CALL RELBIL(IFX)
C.....BEGINNING OF SAVING THE MOST RELIABLE MODE
      XANG (IXHP) = ANGLE (IF)
      XCPB (IXHP) = CPROB (IF)
      XDBL (IXHP) = DBLOS (IF)
      XDBU (IXHP) = DBU   (IF)
      XDELY(IXHP) = DELAY (IF)
      XPMP (IXHP) = PROBMP(IF)
      XREL (IXHP) = RELIAB(IF)
      XSN  (IXHP) = SNDB  (IF)
      XSPB(IXHP) = SPROB (IF)
      XVHI(IXHP) = VHIGH (IF)
       LMOD(IXHP) = NMODE(NREL)
      LNDB(IXHP) = NDBW  (IF)
      LNHP(IXHP)  = NHP   (IF)
      LNOIS(IXHP) =NYNOIS (IF)
      XSNP (IXHP) = SNPR  (IF)
      XREFF(IXHP) = REFF
      IXHT = IXHP
      XDBLL(IXHT) =  DBLOSL(IF)
      XDBLU(IXHT) =  DBLOSU(IF)
      XTGA (IXHT) =  TGAIN(NREL)
      XRGA (IXHT) =  RGAIN(NREL)
      XFSL (IXHT) =  FSLOS(NREL)
      XABS (IXHT) =  ABPS (NREL)
      XOBF (IXHT) =  OBF  (NREL)
      XADL (IXHT) =  ADV  (NREL)
      XGRD (IXHT) =  GRLOS(NREL)
C.....END OF SAVING THE MOST RELIABLE MODE
  262 CONTINUE
C.....END OF THE HOP LOOP
      IXHP = 0
C.....BEGINNING OF SAVING THE MOST RELIABLE MODE FOR EACH HOP
      DO  264  IHOP = IHSRT,IHSTP
      IXHP = IXHP + 1
      TLOSS(IXHP) =   XDBL( IXHP)
      TIMED(IXHP) =  XDELY(IXHP)
      B(IXHP)     =  XANG (IXHP)
      HP(IXHP)    =  XVHI(IXHP)
      FLDST(IXHP) = XDBU(IXHP)
      SIGPOW(IXHP) = LNDB (IXHP)
      SN    (IXHP)=  XSN  (IXHP)
      PROB (IXHP) = XCPB (IXHP)
      CREL(IXHP) = XSNP(IXHP)
      RELY(IXHP) = XREL(IXHP)
      SPRO(IXHP) = XSPB(IXHP)
      NMODE(IXHP)=LMOD(IXHP)
      HN(IXHP)=LNHP(IXHP)
      EFF(IXHP) = XREFF(IXHP)
      TLLOW(IXHP) = XDBLL(IXHP)
      TLHGH(IXHP) = XDBLU(IXHP)
      TGAIN(IXHP) = XTGA (IXHP)
      RGAIN(IXHP) = XRGA (IXHP)
      FSLOS(IXHP) = XFSL (IXHP)
      ABPS (IXHP) = XABS (IXHP)
      OBF  (IXHP) = XOBF (IXHP)
      ADV  (IXHP) = XADL (IXHP)
```

```
  198          GRLOS(IXHP) = XGRD (IXHP)
  199        264 CONTINUE
  200     C.....ENDING OF SAVING THE MOST RELIABLE MODE FOR EACH HOP
  201     C
  202     C
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]LUFFY.FOR;1
  129          IF(IPFG.GT.200)THEN
  130     C.....FREQUENCY COMPLEMENT
  131            CALL FRQCOM(FREA,0)
  132          ENDIF
  133          NHP   (13) = -1
  134          DO 265 IF=1,12
  135          IPFG=IPFLAG
  136          IFX = IF
  137          IF(IPFG.LT.300)THEN
  138     C.....PRESET IN COMMON/SON/
  139            NHP   (IF) = -1
  140            SPROB(IF)=.000
  141            PROBMP(IF)=.000
  142     C.....IS FREQUENCY COMPLEMENT FULL
  143       116  IF (FREL(IF) ) 265,265,120
  144       120  FREQ = FREL(IF)
  145          ELSE
  146            FREQ=FREA(IF)
  147            RELIAB(IF)=0.0
  148          ENDIF
  149     C-------------------------------------------------
  150          if(mspec.eq.125.and.if.gt.11)THEN
  151            go to 265
  152          ELSE
  153            iflag=0
  154            ifqn=if
  155            call allMODES(iflag,freq)
  156          endif
  157          IF((IPFG.EQ.100).OR.(IPFG.EQ.300))THEN
  158            K = JMODE
  159     C.....RAY SET TABLE
  160            CALL FINDF(K)
  161     C.....NOISE DISTRIBUTION
  162            CALL GENOIS
  163            IF( DMAXKM(K) ) 122,122,123
  164       122  IF(IPFG.EQ.300)then
  165              go to 265
  166            else
  167     C.....ONLY ONE OVER THE MUF MODE
  168              IHSRT = NHOPMF(MODMUF)
  169              IHSTP = IHSRT
  170            endif
  171            GO TO 124
  172     C.....UP TO THREE HOPS
  173       123  IHSRT = GCDKM/DMAXKM(K) + 1.
  174            IHSTP = GCDKM/DSKPKM(K)
  175            IHSTP = MAX0(IHSTP,IHSRT)
  176            IHSTP =MIN0(IHSTP,IHSRT+2)
  177       124  IXHP = 0
```

```
  178   C.......HOP LOOP
  179           DO 262 IHOP = IHSRT, IHSTP
  180           IXHP = IXHP + 1
  181           HOP = IHOP
  182   C.......HOP DISTANCE
  183           GHOP = GCD/HOP
  184   C.......FIND UP TO SIX MODES
  185           CALL REGMOD
  186   C.......SAVE ALL MODES AVAILABLE
  187           CALL ALLMODES(IPFG,HOP)
  188     262   CONTINUE
  189   C.......END OF THE HOP LOOP
  190   C
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]LUFFY.FOR;1
  205         CALL INMOD(IFX)
  206   C.....UP TO 2 ES MODES
  207         CALL ESMOD
  208   C.....ONE ES - F MODES
  209         CALL ESREG
  210   C.....COMBINED RELIABILITY
  211         CALL RELBIL(IFX)
  212   C.....CHECK TO SEE IF SERVICE PROBABILITIES ARE TO BE OUTPUT
  213         IF( LINBOT(14) ) 285,285,280
  214   C.....CALCULATE SERVICE PROBABILITIES
  215     280 CALL SERPRB(IFX)
  216     285 CONTINUE
  217   C.....CALCULATE MULTIPATH
  218         CALL MPATH(IFX)
  219   C.....ALL MODE OUTPUT
  220         CALL OUTALL(IF)
  221   C.....TEMP FOR OVER MUF VHF
  222         CALL CALVHF(IF)
  223     265 CONTINUE
  224   C.....END OF FREQUENCY LOOP
  225     270 CONTINUE
  226         RETURN
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]LUFFY.FOR;1
  193     268   IF(NMMOD.LT.1)THEN
  194   C.........FIND AT LEAST ONE MODE
  195             CALL INMOD(IFX,ipfg)
  196           ENDIF
  197   C.......UP TO 2 ES MODES
  198           CALL ESMOD
  199   C.......ONE ES - F MODES
  200           CALL ESREG
  201           CALL ALLMODES(2,999.)
  202         ELSE
  203   C.......NOISE DISTRIBUTION
  204           CALL GENOIS
  205   C.......AREA COVERAGE, TRANSMITTER END
  206           CALL FINDF(1)
  207   C.......AREA COVERAGE, RECEIVER END
  208           CALL FINDF(3)
  209   C.......GAIN MINUS LOSS
  210           CALL GMLOSS
```

```
C.......SELECT OPTIMUM AT TRANSMITTER END
        CALL SELTMT
C.......SELECT OPTIMUM AT RECEIVER END
        CALL SELRCR
C.......DO MODE CALCULATIONS
        CALL LNGPAT
        CALL ALLMODES(1,999.)
      ENDIF
      IF(MSPEC.EQ.125)GO TO 265
C.....COMBINED RELIABILITY
      call relbil(ifx)
      IF(IPFG.LT.300)THEN
C.......CHECK TO SEE IF SERVICE PROBABILITIES ARE TO BE OUTPUT
        IF( LINBOT(14) ) 285,285,280
C.......CALCULATE SERVICE PROBABILITIES
  280   CALL SERPRB(IFX)
  285   CONTINUE
        IF(IPFG.EQ.100)THEN
C.........CALCULATE MULTIPATH
          CALL MPATH(IFX)
        ELSE
C.........SET RECEIVER END
          IS = NMODE(2)
          MODER(IF) = LAYTYP(IS)
          ANGLER(IF) = B(2)
        ENDIF
C.......normal ALL MODE OUTPUT
        CALL OUTALL(IF)
C.......TEMP FOR OVER MUF VHF
        CALL CALVHF(IF)
      ELSE
C.......TEST RELIABILITY
  140   IF(RELIAB(IF).GE.PLUF)GO TO 165
      ENDIF
  265 CONTINUE
C.....END OF FREQUENCY LOOP
      if(mspec.eq.125.or.method.eq.25)return
  270 CONTINUE
      IF(IPFG.LT.300)RETURN
C     NO LUF FOUND. ,FIND HIGHEST RELIABILITY AND QUIT.
  150 CONTINUE
      IG =1
      REL = RELIAB(1)
      DO 160 IF = 2,12
      IF(RELIAB(IF) - REL) 160, 160, 155
  155 IG = IF
  160 CONTINUE
      XLUF(IT) = -FREA(IG)
      FREA(13) =  FREA(IG)
      RETURN
  165 CONTINUE
      IF( IF -1) 170,170,175
C FIRST FREQUENCY IS GOOD.
  170 XLUF(IT) = FREQ
      FREA(13)  = FREQ
      RETURN
```

```
  267   C.....NO ITERATION, SELECT THE FREQUENCY COMPLEMENT FIRST
  268     175 CONTINUE
  269     190 FLOW = FREA(IF-1)
  270         FHIGH= FREA(IF)
  271         RLOW = RELIAB(IF-1)
  272         RHIGH= RELIAB(IF)
  273         IF = 13
  274   C.....USE LINEAR INTERPOLATION
  275         XLUF(IT) = FLOW + (FHIGH - FLOW) * (PLUF - RLOW) / (RHIGH - RLOW)
  276         FREA(13) = XLUF(IT)
  277         RETURN
************
```

Number of difference sections found: 8
Number of difference records found: 290

MAGFIN.FOR

Number of difference sections found: 0
Number of difference records found: 0

MAGVAR.FOR

```
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]MAGVAR.FOR;1
   15          COMMON /RON /CLAT (5), CLONG (5), GLAT (5), RD (5), FI (3, 5), YI
   16         1(3, 5), HI (3, 5), HPRIM (30, 3), HTRUE (30, 3), FVERT (30, 3), KM
   17         2, KFX
   18          COMMON /GEOG /GY (5), RAT (5), GMDIP (5)
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]MAGVAR.FOR;1
   15          COMMON /RON /CLAT(5), CLONG(5), GLAT(5), RD(5), FI(3,5), YI(3,5),
   16         1HI(3,5), HPRIM(30,5), HTRUE(30,5), FVERT(30,5),KM,KFX, AFAC(30,5),
   17         2HTR(50), FNSQ(50)
   18          COMMON /GEOG /GY (5), RAT (5), GMDIP (5)
************
```

Number of difference sections found: 1
Number of difference records found: 3

MONITR.D1F

Number of difference sections found: 0
Number of difference records found: 0

MPATH.FOR

```
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]MPATH.FOR;1
    7         1 GCDKM, PMP, PWR, RLAT, RLATD, RLONG, RLONGD, RSN, SIGTR, TLAT, TL
    8         2ATD, TLONG, TLONGD, BRTD, FLUX, SSN, ATMNO
    9          COMMON /MODES /GHOP, DELMOD (6, 3), HPMOD (6, 3), HTMOD (6, 3), FV
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]MPATH.FOR;1
    7         1 GCDKM, PMP, PWR, RLAT, RLATD, RLONG, RLONGD, RSN, SIGTR, TLAT,
    8         2 TLATD,TLONG,TLONGD,BRTD,FLUX,SSN,D90R,D50R,D10R,D90S,D50S,D10S
    9          COMMON /MODES /GHOP, DELMOD (6, 3), HPMOD (6, 3), HTMOD (6, 3), FV
```

MPATH.FOR (cont'd.)

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************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]MPATH.FOR;1
   12         A DBLOSL(13), DBLOSU(13), DBU(13), DELAY(13), NDBW(13), NHP(13),
   13         B NYNOIS(13), PROBMP(13), RELIAB(13), SNDB(13), SNPR(13),
   14         C SNRLW(13), SNRUP(13), SPROB(13), VHIGH(13)
   15          COMMON / ZON / ABPS(7), CREL(7), EFF(7), FLDST(7), GRLOS(7),
   16         1HN (7), HP (7), PROB (7), RELY (7), RGAIN (7), SIGPOW (7), SN (7),
   17         2 SPRO (7), TGAIN (7), TIMED (7), TLOSS (7), B (7), FSLOS (7), ADV
   18         C (7),OBF(7),NMODE(7),NPROB,NREL
   19          IF(DMP) 95,95,100
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]MPATH.FOR;1
   12         A DBLOSL(13), DBLOSU(13), DBU(13), DELAY(13), DBW(13), NHP(13),
   13         B NYNOIS(13), PROBMP(13), RELIAB(13), SNDB(13), SNPR(13),
   14         C SNRLW(13), SNRUP(13), SPROB(13), VHIGH(13)
   15          COMMON / allMODE /ABPS(20),CREL(20),FLDST(20),HN(20),HP(20),
   16         1PROB(20),RELY(20),RGAIN(20),SIGPOW(20),SN(20),
   17         2SPRO(20),TGAIN(20),TIMED(20),TLOSS(20),B(20),FSLOS(20),
   18         CNMODE(20),TLLOW(20),TLHGH(20),EFF(20),NREL,NMMOD
   19          IF(DMP) 95,95,100
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]MPATH.FOR;1
   25          DO 135 IM = 1,6
   26          IF( IM - NREL)  105,135,105
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]MPATH.FOR;1
   25          DO 135 IM = 1,NMMOD
   26          IF( IM - NREL)  105,135,105
************
```

Number of difference sections found: 3
Number of difference records found: 10

NOISY.FOR

Number of difference sections found: 0
Number of difference records found: 0

NONMUF.FOR

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************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]NOMMUF.FOR;1
    9          COMMON/RON/CLAT(5),CLONG(5),GLAT(5),RD(5),FI(3,5),YI(3,5),HI(3,5)
   10         A,HPRIM(30,3),HTRUE(30,3),FVERT(30,3),KM,KFX,AFAC(30,3),HNOR(3)
   11          COMMON/DON/ALATD,AMIN,AMIND,BTR,BTRD,DLONG,DMP,ERTR,GCD,GCDKM,PMP
   12         A ,PWR,RLAT,RLATD,RLONG,RLONGD,RSN,SIGTR,TLAT,TLATD,TLONG,TLONGD
   13         B ,BRTD,FLUX,SSN,ATMNO
   14          COMMON/TIME/IT,GMT,UTIME(24)
   15          COMMON / MFAC / F2M3(5), HPF2(5), ZENANG(5), ZENMAX(5)
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]NOMMUF.FOR;1
    9          COMMON /RON /CLAT(5), CLONG(5), GLAT(5), RD(5), FI(3,5), YI(3,5),
   10         1HI(3,5), HPRIM(30,5), HTRUE(30,5), FVERT(30,5),KM,KFX, AFAC(30,5),
   11         2HTR(50), FNSQ(50)
   12          COMMON /DON /ALATD, AMIN, AMIND, BTR, BTRD, DLONG, DMP, ERTR, GCD,
   13         1 GCDKM, PMP, PWR, RLAT, RLATD, RLONG, RLONGD, RSN, SIGTR, TLAT,
   14         2 TLATD,TLONG,TLONGD,BRTD,FLUX,SSN,D90R,D50R,D10R,D90S,D50S,D10S
   15          COMMON / TIME / IT, GMT, UTIME(24), GMTR, XLMT(24), ITIM, JTX
   16          COMMON / MFAC / F2M3(5), HPF2(5), ZENANG(5), ZENMAX(5)
```

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************
                    Number of difference sections found: 1
                    Number of difference records  found: 7
```

OUTALL.FOR

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************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]OUTALL.FOR;1
     9          COMMON/ANOIS/ATNU,ATNY,CC,TM,XEFF,RCNSE,DU,DL,SIGM,SIGU,SIGL,KJ,JK
    10          COMMON / DON / ALATD, AMIN, AMIND, BTR, BTRD, DLONG, DMP, ERTR,
    11         1 GCD, GCDKM, PMP, PWR, RLAT, RLATD, RLONG, RLONGD, RSN, SIGTR,
    12         2 TLAT, TLATD, TLONG, TLONGD, BRTD, FLUX, SSN, ATMNO, D90R, D50R,
    13         3 D10R, D90S, D50S, D10S
    14          COMMON / FRQ / FREL(29), FREQ
    15          COMMON /GEOG /GYZ (5), RAT (5), GMDIP (5), CLCK (5), ABIY (5), ART
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]OUTALL.FOR;1
     9          COMMON/ANOIS/ATNU,ATNY,CC,TM,RCNSE,DU,DL,SIGM,SIGU,SIGL,KJ,JK
    10          COMMON /DON /ALATD, AMIN, AMIND, BTR, BTRD, DLONG, DMP, ERTR, GCD,
    11         1 GCDKM, PMP, PWR, RLAT, RLATD, RLONG, RLONGD, RSN, SIGTR, TLAT,
    12         2 TLATD,TLONG,TLONGD,BRTD,FLUX,SSN,D90R,D50R,D10R,D90S,D50S,D10S
    13          COMMON / FRQ / FREL(29), FREQ, JMODE
    14          COMMON /GEOG /GYZ (5), RAT (5), GMDIP (5), CLCK (5), ABIY (5), ART
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]OUTALL.FOR;1
    23          COMMON / METSET / VERSN, ITRUN, ITOUT, JTRUN(40), JTOUT(40)
    24          COMMON /MODES /GHOP, DELMOD (6, 3), HPMOD (6, 3), HTMOD (6, 3), FV
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]OUTALL.FOR;1
    22          COMMON / METSET / VERSN, ITRUN, ITOUT, JTRUN(40), JTOUT(40), LSEAS
    23          COMMON /MODES /GHOP, DELMOD (6, 3), HPMOD (6, 3), HTMOD (6, 3), FV
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]OUTALL.FOR;1
    30          COMMON /RON /CLAT (5), CLONG (5), GLAT (5), RD (5), FI (3, 5), YI
    31         1(3, 5), HI (3, 5), HPRIM (30, 3), HTRUE (30, 3), FVERT (30, 3), KM
    32         2, KFX, AFAC (30, 3), HNOR (3)
    33          COMMON /RTANT /XETA, XSIG, XEPS, XND, XNL, XNH, TEX (4), ITANT, IR
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]OUTALL.FOR;1
    29          COMMON /RON /CLAT(5), CLONG(5), GLAT(5), RD(5), FI(3,5), YI(3,5),
    30         1HI(3,5), HPRIM(30,5), HTRUE(30,5), FVERT(30,5),KM,KFX, AFAC(30,5),
    31         2HTR(50), FNSQ(50)
    32          COMMON /RTANT /XETA, XSIG, XEPS, XND, XNL, XNH, TEX (4), ITANT, IR
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]OUTALL.FOR;1
    36         A DBLOSL(13), DBLOSU(13), DBU(13), DELAY(13), NDBW(13), NHP(13),
    37         B NYNOIS(13), PROBMP(13), RELIAB(13), SNDB(13), SNPR(13),
    38         C SNRLW(13), SNRUP(13), SPROB(13), VHIGH(13)
    39          COMMON /TIME /IT, GMT, UTIME (24)
    40          COMMON / TON / ADJ, ADS, ATMO, GNOS, GOT, PWRDB, ZCNSE, REL, SL,
    41         2 SLS, SPR, SU, SUS, TIMER, XADJN, ZEFF, XNOISE, XTLOS, ZNOISE, NF
    42          COMMON / ZON / ABPS(7), CREL(7), EFF(7), FLDST(7), GRLOS(7),
    43         1 HN(7), HP(7), PROB(7), RELY(7), RGAIN(7), SIGPOW(7), SN(7),
    44         2 SPRO(7), TGAIN(7), TIMED(7), TLOSS(7), B(7), FSLOS(7), ADV(7),
    45         C OBF(7),NMODE(7),NPROB,NREL,TLLOW(7),TLHGH(7)
```

```
   46          COMMON/SIGD/DSL,AMS,DSU,AGLAT,DSLF,ASMF,DSUF,ACAV,FEAV,AFE,BFE,HNU
   47         A ,HTLOSS,XNUZ,XVE
   48          DIMENSION TEMP(6)
   49          CHARACTER MODE*2, LAYTYP*2
   50          CHARACTER NNAME(22)*10, ISTAR*1, ITEMP(6)*2
   51          CHARACTER IMON*3, IRCVR*10, ITRAN*10, MODER*2, MODVHF*2, IRLAT*1,
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]OUTALL.FOR;1
   35         A DBLOSL(13), DBLOSU(13), DBU(13), DELAY(13), DBW(13), NHP(13),
   36         B NYNOIS(13), PROBMP(13), RELIAB(13), SNDB(13), SNPR(13),
   37         C SNRLW(13), SNRUP(13), SPROB(13), VHIGH(13)
   38          COMMON / TIME / IT, GMT, UTIME(24), GMTR, XLMT(24), ITIM, JTX
   39          COMMON / TON / ADJ, ADS, GNOS, GOT, PWRDB, REL, SL,
   40         2 SLS, SPR, SU, SUS, XNOISE, ZNOISE, NF
   41          COMMON / allMODE /ABPS(20),CREL(20),FLDST(20),HN(20),HP(20),
   42         1PROB(20),RELY(20),RGAIN(20),SIGPOW(20),SN(20),
   43         2SPRO(20),TGAIN(20),TIMED(20),TLOSS(20),B(20),FSLOS(20),
   44         CNMODE(20),TLLOW(20),TLHGH(20),EFF(20),NREL,NMMOD
   45          COMMON/SIGD/DSL,AMS,DSU,AGLAT,DSLF,ASMF,DSUF,ACAV,FEAV,AFE,BFE,HNU
   46         A ,HTLOSS,XNUZ,XVE
   47          CHARACTER MODE*2, LAYTYP*2
   48          CHARACTER NNAME(22)*10, ISTAR*1, ITEMP(20)*2
   49          CHARACTER IMON*3, IRCVR*10, ITRAN*10, MODER*2, MODVHF*2, IRLAT*1,
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]OUTALL.FOR;1
   54          DATA NNAME/' TIME DEL.', ' ANGLE    ', ' ABSORB   ',
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]OUTALL.FOR;1
   52          CHARACTER f505*18,f512*34,f513*28
   53          DATA NNAME/' TIME DEL.', ' ANGLE    ', ' ABSORB   ',
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]OUTALL.FOR;1
   61          IF(METHOD - 25) 625, 100, 625
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]OUTALL.FOR;1
   60          data f505,f512,f513/'(   x,9h Most REL)','(11x,  (3x,f4.0,a2,1x),2
   61         +x,f4.0,a2)','(1x,a10,  (1x,f9.2),2x,f9.2)'/
   62          IF(METHOD - 25) 625, 100, 625
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]OUTALL.FOR;1
   75          SIGPW = NDBW(IF)
   76          WRITE(JOUT,501) FREQ, GMT
   77          WRITE(JOUT,505)
   78          KNT = 0
   79          DO 250 IM = 1,6
   80          IF(ABS(TEMP(IM)) + 1.) 250, 250, 240
   81      240 KNT = KNT + 1
   82          TEMP(KNT) = HN(IM)
   83          IS = NMODE(IM)
   84          ITEMP(KNT) = LAYTYP(IS)
   85      250 CONTINUE
   86          WRITE(JOUT,512) (TEMP(IM),ITEMP(IM),IM=1,KNT), XNHP, MODE(IF)
   87          KNT = 0
```

```
      DO 270 IM = 1,6
      IF(HN(IM) + 1.) 270, 270, 260
  260 KNT = KNT + 1
      TEMP(KNT) = TIMED(IM)
  270 CONTINUE
      WRITE(JOUT,513) NNAME(1), (TEMP(IM),IM=1,KNT), DELAY(IF)
      KNT = 0
      DO 290 IM = 1,6
      IF(HN(IM) + 1.) 290, 290, 280
  280 KNT = KNT + 1
      TEMP(KNT) = B(IM)
  290 CONTINUE
      WRITE(JOUT,513) NNAME(2), (TEMP(IM),IM=1,KNT), ANGLE(IF)
      KNT = 0
      DO 310 IM = 1,6
      IF(HN(IM) + 1.) 310, 310, 300
  300 KNT = KNT + 1
      TEMP(KNT) = HP(IM)
  310 CONTINUE
      WRITE(JOUT,513) NNAME(18), (TEMP(IM),IM=1,KNT), VHIGH(IF)
      KNT = 0
      DO 314 IM = 1,6
      IF(HN(IM) + 1.) 314, 314, 312
  312 KNT = KNT + 1
      TEMP(KNT) = TLOSS(IM)
  314 CONTINUE
      WRITE(JOUT,513) NNAME(9), (TEMP(IM),IM=1,KNT), DBLOS(IF)
      KNT = 0
      DO 705 IM = 1,5
      IF(HN(IM)) 705,705,700
  700 KNT = KNT + 1
       TEMP(KNT) = TGAIN(IM)
  705 CONTINUE
      WRITE(JOUT,513) NNAME(5),(TEMP(IM),IM=1,KNT),TGAIN(NREL)
      KNT = 0
      DO 715 IM = 1,5
      IF(HN(IM)) 715,715,710
  710 KNT = KNT + 1
       TEMP(KNT) = RGAIN(IM)
  715 CONTINUE
      WRITE(JOUT,513) NNAME(19), (TEMP(IM),IM=1,KNT), RGAIN(NREL)
      KNT = 0
      DO 725 IM = 1,5
      IF(HN(IM)) 725,725,720
  720 KNT = KNT + 1
       TEMP(KNT) =  ABPS(IM)
  725 CONTINUE
      WRITE(JOUT,513) NNAME(3),(TEMP(IM),IM=1,KNT)
      KNT = 0
      DO 735 IM = 1,5
      IF(HN(IM)) 735,735,730
  730 KNT = KNT + 1
       TEMP(KNT) = FSLOS(IM)
  735 CONTINUE
      WRITE(JOUT,513) NNAME(4),(TEMP(IM),IM=1,KNT)
      KNT = 0
      DO 330 IM = 1,6
      IF(HN(IM) + 1.) 330, 330, 320
  320 KNT = KNT + 1
```

```
147          TEMP(KNT) = FLDST(IM)
148       330 CONTINUE
149          WRITE(JOUT,513) NNAME(10), (TEMP(IM),IM=1,KNT), DBU(IF)
150          KNT = 0
151          DO 350 IM = 1,6
152          IF(HN(IM) + 1.) 350, 350, 340
153       340 KNT = KNT + 1
154          TEMP(KNT) = SIGPOW(IM)
155       350 CONTINUE
156          WRITE(JOUT,513) NNAME(11), (TEMP(IM),IM=1,KNT), SIGPW
157          KNT = 0
158          DO 370 IM = 1,6
159          IF(HN(IM) + 1.) 370, 370, 360
160       360 KNT = KNT + 1
161          TEMP(KNT) = SN(IM)
162       370 CONTINUE
163          WRITE(JOUT,513) NNAME(12), (TEMP(IM),IM=1,KNT), SNDB(IF)
164          KNT = 0
165          DO 390 IM = 1,6
166          IF(HN(IM) + 1.) 390, 390, 380
167       380 KNT = KNT + 1
168          TEMP(KNT) = PROB(IM)
169       390 CONTINUE
170          WRITE(JOUT,513) NNAME(13), (TEMP(IM),IM=1,KNT), CPROB(IF)
171          KNT = 0
172          DO 410 IM = 1,6
173          IF(HN(IM) + 1.) 410, 410, 400
174       400 KNT = KNT + 1
175          TEMP(KNT) = CREL(IM)
176       410 CONTINUE
177          WRITE(JOUT,513) NNAME(14), (TEMP(IM),IM=1,KNT), SNPR(IF)
178          KNT = 0
179          DO 430 IM = 1,6
180          IF(HN(IM) + 1.) 430, 430, 420
181       420 KNT = KNT + 1
182          TEMP(KNT) = RELY(IM)
183       430 CONTINUE
184          WRITE(JOUT,513) NNAME(15), (TEMP(IM),IM=1,KNT), RELIAB(IF)
185          KNT = 0
186          DO 450 IM = 1,6
187          IF(HN(IM) + 1.) 450, 450, 440
188       440 KNT = KNT + 1
189          TEMP(KNT) = SPRO(IM)
190       450 CONTINUE
191          WRITE(JOUT,513) NNAME(16), (TEMP(IM),IM=1,KNT), SPROB(IF)
192          KNT = 0
193          DO  490 IM = 1,6
194          IF( HN(IM) + 1.)  490,490,480
195       480 KNT = KNT +1
196          TEMP (KNT) = TLLOW (IM)
197       490 CONTINUE
198          WRITE(JOUT,513) NNAME(21), (TEMP(IM),IM =1,KNT),DBLOSL(IF)
199          KNT =0
200          DO 620 IM = 1,6
201          IF( HN(IM) +1. ) 620,620,610
202       610 KNT = KNT + 1
203          TEMP(KNT) = TLHGH(IM)
204       620 CONTINUE
```

```
  205          WRITE(JOUT,513) NNAME(22), (TEMP(IM),IM=1,KNT) ,DBLOSU(IF)
  206          WRITE(JOUT,511) NYNOIS(IF), NDBW(IF)
  207          WRITE(JOUT,502) DSL,AMS,DSU,SLS,ADS,SUS
  208          WRITE(JOUT,503) DU, RCNSE, DL, SIGU, SIGM, SIGL
  209    C
  210          WRITE(JOUT,506) D90R, D50R, D10R
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]OUTALL.FOR;1
   76          SIGPW = DBW(IF)
   77          WRITE(JOUT,501) NMMOD,FREQ, GMT
   78          IST=NMMOD
   79          DO 250 IM = 1,IST
   80          IS = NMODE(IM)
   81          ITEMP(IM) = LAYTYP(IS)
   82      250 CONTINUE
   83          if(NMMOD.lt.12)then
   84            IST1=10*IST+13
   85            write(f505(2:4),'(i3)')IST1
   86            write(f512(6:7),'(i2)')IST
   87            write(f513(9:10),'(i2)')IST
   88            WRITE(JOUT,f505)
   89            WRITE(JOUT,f512) (HN(IM),ITEMP(IM),IM=1,IST), XNHP, MODE(IF)
   90            WRITE(JOUT,f513) NNAME(1), (timed(IM),IM=1,ist), DELAY(IF)
   91            WRITE(JOUT,f513) NNAME(2), (B(IM),IM=1,IST), ANGLE(IF)
   92            WRITE(JOUT,f513) NNAME(18), (hp(IM),IM=1,ist), VHIGH(IF)
   93            WRITE(JOUT,f513) NNAME(9), (TLOSS(IM),IM=1,IST), DBLOS(IF)
   94            WRITE(JOUT,f513) NNAME(5),(TGAIN(IM),IM=1,IST),TGAIN(NREL)
   95            WRITE(JOUT,f513) NNAME(19), (RGAIN(IM),IM=1,IST), RGAIN(NREL)
   96            WRITE(JOUT,f513) NNAME(3),(abps(IM),IM=1,ist)
   97            WRITE(JOUT,f513) NNAME(4),(fslos(IM),IM=1,ist)
   98            WRITE(JOUT,f513) NNAME(10), (FLDST(IM),IM=1,IST), DBU(IF)
   99            WRITE(JOUT,f513) NNAME(11), (SIGPOW(IM),IM=1,IST), SIGPW
  100            WRITE(JOUT,f513) NNAME(12), (SN(IM),IM=1,IST), SNDB(IF)
  101            WRITE(JOUT,f513) NNAME(13), (prob(IM),IM=1,ist), CPROB(IF)
  102            write(jout,f513) NNAME(14), (crel(IM),IM=1,ist), SNPR(IF)
  103            WRITE(JOUT,f513) NNAME(15), (RELY(IM),IM=1,IST), RELIAB(IF)
  104            WRITE(JOUT,f513) NNAME(16), (spro(IM),IM=1,ist), SPROB(IF)
  105            WRITE(JOUT,f513) NNAME(21), (TLLOW(IM),IM =1,IST),DBLOSL(IF)
  106            WRITE(JOUT,f513) NNAME(22), (TLHGH(IM),IM=1,IST) ,DBLOSU(IF)
  107          else
  108            write(f512(6:7),'(2h10)')
  109            write(f513(9:10),'(2h10)')
  110            WRITE(JOUT,f512) (HN(IM),ITEMP(IM),IM=1,10)
  111            WRITE(JOUT,f513) NNAME(1), (timed(IM),IM=1,10)
  112            WRITE(JOUT,f513) NNAME(2), (B(IM),IM=1,10)
  113            WRITE(JOUT,f513) NNAME(18), (hp(IM),IM=1,10)
  114            WRITE(JOUT,f513) NNAME(9), (TLOSS(IM),IM=1,10)
  115            WRITE(JOUT,f513) NNAME(5),(TGAIN(IM),IM=1,10)
  116            WRITE(JOUT,f513) NNAME(19), (RGAIN(IM),IM=1,10)
  117            WRITE(JOUT,f513) NNAME(3),(abps(IM),IM=1,10)
  118            WRITE(JOUT,f513) NNAME(4),(fslos(IM),IM=1,10)
  119            WRITE(JOUT,f513) NNAME(10), (FLDST(IM),IM=1,10)
  120            WRITE(JOUT,f513) NNAME(11), (SIGPOW(IM),IM=1,10)
  121            WRITE(JOUT,f513) NNAME(12), (SN(IM),IM=1,10)
  122            WRITE(JOUT,f513) NNAME(13), (prob(IM),IM=1,10)
  123            write(jout,f513) NNAME(14), (crel(IM),IM=1,10)
  124            WRITE(JOUT,f513) NNAME(15), (RELY(IM),IM=1,10)
  125            WRITE(JOUT,f513) NNAME(16), (spro(IM),IM=1,10)
```

```
 126           WRITE(JOUT,f513) NNAME(21), (TLLOW(IM),IM =1,10)
 127           WRITE(JOUT,f513) NNAME(22), (TLHGH(IM),IM=1,10)
 128           LINES = LINES + NADD
 129           IF(LINES - LINMAX) 330, 330, 320
 130   C.......CALL SUBROUTINE OUTTOP TO OUTPUT HEADER LINES
 131     320   CALL OUTTOP
 132           LINES = LINTOP(10) + NADD
 133     330   WRITE(JOUT,505)
 134           WRITE(JOUT,505)
 135           irem=ist-10
 136           IST1=10*irem+13
 137           write(f505(2:4),'(i3)')IST1
 138           write(f512(6:7),'(i2)')irem
 139           write(f513(9:10),'(i2)')irem
 140           WRITE(JOUT,f505)
 141           WRITE(JOUT,f512) (HN(IM),ITEMP(IM),IM=11,IST), XNHP, MODE(IF)
 142           WRITE(JOUT,f513) NNAME(1), (timed(IM),IM=11,ist), DELAY(IF)
 143           WRITE(JOUT,f513) NNAME(2), (B(IM),IM=11,IST), ANGLE(IF)
 144           WRITE(JOUT,f513) NNAME(18), (hp(IM),IM=11,ist), VHIGH(IF)
 145           WRITE(JOUT,f513) NNAME(9), (TLOSS(IM),IM=11,IST), DBLOS(IF)
 146           WRITE(JOUT,f513) NNAME(5),(TGAIN(IM),IM=11,IST),TGAIN(NREL)
 147           WRITE(JOUT,f513) NNAME(19), (RGAIN(IM),IM=11,IST), RGAIN(NREL)
 148           WRITE(JOUT,f513) NNAME(3),(abps(IM),IM=11,ist)
 149           WRITE(JOUT,f513) NNAME(4),(fslos(IM),IM=11,ist)
 150           WRITE(JOUT,f513) NNAME(10), (FLDST(IM),IM=11,IST), DBU(IF)
 151           WRITE(JOUT,f513) NNAME(11), (SIGPOW(IM),IM=11,IST), SIGPW
 152           WRITE(JOUT,f513) NNAME(12), (SN(IM),IM=11,IST), SNDB(IF)
 153           WRITE(JOUT,f513) NNAME(13), (prob(IM),IM=11,ist), CPROB(IF)
 154           write(jout,f513) NNAME(14), (crel(IM),IM=11,ist), SNPR(IF)
 155           WRITE(JOUT,f513) NNAME(15), (RELY(IM),IM=11,IST), RELIAB(IF)
 156           WRITE(JOUT,f513) NNAME(16), (spro(IM),IM=11,ist), SPROB(IF)
 157           WRITE(JOUT,f513) NNAME(21), (TLLOW(IM),IM =11,IST),DBLOSL(IF)
 158           WRITE(JOUT,f513) NNAME(22), (TLHGH(IM),IM=11,IST) ,DBLOSU(IF)
 159         endif
 160         WRITE(JOUT,511) NYNOIS(IF), DBW(IF)
 161         WRITE(JOUT,502) DSL,AMS,DSU,SLS,ADS,SUS
 162         WRITE(JOUT,503) DU, RCNSE, DL, SIGU, SIGM, SIGL
 163         WRITE(JOUT,506) D90R, D50R, D10R
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]OUTALL.FOR;1
  213     501 FORMAT(' ',20X,'FREQ = ',F5.1,' MHZ',2X,'UT = ',F5.1)
  214     502 FORMAT(' ',' SIGNAL =',3(2X,F5.1),'  /',3(2X,F5.1))
  215     503 FORMAT(' ',' NOISE = ',3F7.1,'  /',3F8.1)
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]OUTALL.FOR;1
  166     501 FORMAT(' SUMMARY  ',I3,' MODES   FREQ = ',F5.1,' MHZ  UT = ',F5.1)
  167     502 FORMAT(' ',' SIGNAL =',3(2X,   5x),'  /',3(2X,F5.1))
  168     503 FORMAT(' ',' NOISE = ',3F7.1,'  /',3F8.1)
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]OUTALL.FOR;1
  219     511 FORMAT(' ',' NOISE = ',I6,5X,' S. POWER = ',I6)
  220     512 FORMAT(' ',10X,7(3X,F4.0,A2,1X))
  221     513 FORMAT(' ',A10,7(1X,F9.3))
  222         END
```

OUTALL.FOR (cont'd.)

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******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]OUTALL.FOR;1
  172     511 FORMAT(' ',' NOISE = ',I6,5X,' S. POWER = ',F6.1)
  173         END
************
                    Number of difference sections found: 9
                    Number of difference records  found: 168
```

OUTANT.FOR

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************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]OUTANT.FOR;1
   17         C NUMNAM, NUPROC, MAXMET
   18          COMMON / ION / IANT(3,2), NTR(2), IEA, IFQB, IFQE, IGRAPH, IHRE,
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]OUTANT.FOR;1
   17         C NUMNAM, NUPROC, MAXMET, mspec, ml00
   18          COMMON / ION / IANT(3,2), NTR(2), IEA, IFQB, IFQE, IGRAPH, IHRE,
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]OUTANT.FOR;1
   23          COMMON / METSET / VERSN, ITRUN, ITOUT
   24          COMMON / OUTPRT / LINBOT(30), LINBD(14), LINTOP(15), LINTP(14),
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]OUTANT.FOR;1
   23          COMMON / METSET / VERSN, ITRUN, ITOUT, JTRUN(40), JTOUT(40), LSEAS
   24          COMMON / OUTPRT / LINBOT(30), LINBD(14), LINTOP(15), LINTP(14),
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]OUTANT.FOR;1
   94         A ,I =14,30,2),M,LET
   95     140 CONTINUE
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]OUTANT.FOR;1
   94         A ,I =14,30,2)
   95     140 CONTINUE
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]OUTANT.FOR;1
  113     500 FORMAT('1',32X,'METHOD',I3,3X,'IONCAP ',F5.2,3X,'PAGE',I4,/)
  114     502 FORMAT(' ','ITS-',I2,' ANTENNA PACKAGE',26X,'ANTENNA PATTERN',
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]OUTANT.FOR;1
  113     500 FORMAT(1H1,32X,'METHOD',I3,3X,'IONCAP ',F5.2,3X,'PAGE',I4,/)
  114     502 FORMAT(' ','ITS-',I2,' ANTENNA PACKAGE',26X,'ANTENNA PATTERN',
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]OUTANT.FOR;1
  120     508 FORMAT(1X,A1,1X,I2,21F6.1,1X,I2,1X,A1)
  121     510 FORMAT('0',48X,'FREQUENCY IN MEGAHERTZ')
  122     512 FORMAT('0',48X,'ANTENNA EFFICIENCY',/,' ',4X,21F6.1)
  123         END
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]OUTANT.FOR;1
  120     508 FORMAT(1X,A1,1X,I2,21F6.1)
  121     510 FORMAT(/,/,48X,'FREQUENCY IN MEGAHERTZ')
  122     512 FORMAT(/,/,48X,'ANTENNA EFFICIENCY',/,' '4X,21F6.1)
  123     END
```

OUTANT.FOR (cont'd.)

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************
                    Number of difference sections found: 5
                    Number of difference records  found: 7
```

OUTBOD.FOR

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************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]OUTBOD.FOR;1
   14         C NUMNAM, NUPROC, MAXMET
   15          COMMON / FILES / LUI, LUO, LU2, LU5, LU6, LU15, LU16, LU20, LU25,
   16         A LU26, LU35, LU61
   17          COMMON/DON/ALATD,AMIN,AMIND,BTR,BTRD,DLONG,DMP,ERTR,GCD,GCDKM,PMP
   18         A ,PWR,RLAT,RLATD,RLONG,RLONGD,RSN,SIGTR,TLAT,TLATD,TLONG,TLONGD
   19         B ,BRTD,FLUX,SSN,ATMNO
   20          COMMON/LPATH/ GCDLNG,TGML(45),RGML(45),DELOPT,GMIN,YMIN,LTGM,LRGM
   21          COMMON/FRQ/FREL(29),FREQ
   22          COMMON/MUFS/EMUF(24),F1MUF(24),F2MUF(24),ESMUF(24),ALLMUF(24)
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]OUTBOD.FOR;1
   14         C NUMNAM, NUPROC, MAXMET, mspec, m100
   15          COMMON / FILES / LUI, LUO, LU2, LU5, LU6, LU15, LU16, LU20, LU25,
   16         A LU26, LU35, LU61
   17          COMMON /DON /ALATD, AMIN, AMIND, BTR, BTRD, DLONG, DMP, ERTR, GCD,
   18         1 GCDKM, PMP, PWR, RLAT, RLATD, RLONG, RLONGD, RSN, SIGTR, TLAT,
   19         2 TLATD,TLONG,TLONGD,BRTD,FLUX,SSN,D90R,D50R,D10R,D90S,D50S,D10S
   20          COMMON/LPATH/ GCDLNG,TGML(45),RGML(45),DELOPT,GMIN,YMIN,LTGM,LRGM
   21          COMMON / FRQ / FREL(29), FREQ, JMODE
   22          COMMON/MUFS/EMUF(24),F1MUF(24),F2MUF(24),ESMUF(24),ALLMUF(24)
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]OUTBOD.FOR;1
   28         A DBLOSL(13), DBLOSU(13), DBU(13), DELAY(13), NDBW(13), NHP(13),
   29         B NYNOIS(13), PROBMP(13), RELIAB(13), SNDB(13), SNPR(13),
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]OUTBOD.FOR;1
   28         A DBLOSL(13), DBLOSU(13), DBU(13), DELAY(13), DBW(13), NHP(13),
   29         B NYNOIS(13), PROBMP(13), RELIAB(13), SNDB(13), SNPR(13),
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]OUTBOD.FOR;1
   34          COMMON/TIME/ IT,GMT,UTIME(24)
   35          CHARACTER NBLANK*6, NFIVE*6, NSEVEN*6, NEIGHT*6, NDASH*4, LNG4*6,
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]OUTBOD.FOR;1
   34          COMMON / TIME / IT, GMT, UTIME(24), GMTR, XLMT(24), ITIM, JTX
   35          CHARACTER NBLANK*6, NFIVE*6, NSEVEN*6, NEIGHT*6, NDASH*4, LNG4*6,
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]OUTBOD.FOR;1
   41          DATA NBLANK/'      '/, NFIVE/',1X)  '/, NSEVEN/'(A4,1X'/
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]OUTBOD.FOR;1
   41          INTEGER ITMP(13)
   42          DATA NBLANK/'      '/, NFIVE/',1X)  '/, NSEVEN/'(A4,1X'/
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]OUTBOD.FOR;1
  118      225 IFMT(4) = NFMT(3)
  119          CALL FLOLIN(VHIGH,4)
  120      230 IF(LINBOD(5)) 240, 240, 235
```

```
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]OUTBOD.FOR;1
  119     225 IFMT(4) = NFMT(2)
  120         DO 226 II=1,13
  121     226 ITMP(II)=vhigh(II)+SIGN(.5,vhigh(II))
  122         CALL FIXLIN(ITMP,4)
  123     230 IF(LINBOD(5)) 240, 240, 235
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]OUTBOD.FOR;1
  124     245 IFMT(4) = NFMT(3)
  125         CALL FLOLIN(DBLOS,6)
  126     250 IF(LINBOD(7)) 260, 260, 255
  127     255 IFMT(4) = NFMT(3)
  128         CALL FLOLIN(DBU,7)
  129     260 IF(LINBOD(8)) 270, 270, 265
  130     265 IFMT(4) = NFMT(2)
  131         CALL FIXLIN(NDBW,8)
  132     270 IF(LINBOD(9)) 280, 280, 275
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]OUTBOD.FOR;1
  127     245 IFMT(4) = NFMT(2)
  128         DO 246 II=1,13
  129     246 ITMP(II)=dblos(II)+SIGN(.5,dblos(II))
  130         CALL FIXLIN(ITMP,6)
  131     250 IF(LINBOD(7)) 260, 260, 255
  132     255 IFMT(4) = NFMT(2)
  133         DO 256 II=1,13
  134     256 ITMP(II)=dbu(II)+SIGN(.5,dbu(II))
  135         CALL FIXLIN(ITMP,7)
  136     260 IF(LINBOD(8)) 270, 270, 265
  137     265 IFMT(4) = NFMT(2)
  138         DO 266 II=1,13
  139     266 ITMP(II)=DBW(II)+SIGN(.5,DBW(II))
  140         CALL FIXLIN(ITMP,8)
  141     270 IF(LINBOD(9)) 280, 280, 275
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]OUTBOD.FOR;1
  136     285 IFMT(4) = NFMT(3)
  137         CALL FLOLIN(SNDB,10)
  138     290 IF(LINBOD(11)) 300, 300, 295
  139     295 IFMT(4) = NFMT(3)
  140         CALL FLOLIN(SNPR,11)
  141     300 IF(LINBOD(12)) 310, 310, 305
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]OUTBOD.FOR;1
  145     285 IFMT(4) = NFMT(2)
  146         DO 286 II=1,13
  147     286 ITMP(II)=sndb(II)+SIGN(.5,sndb(II))
  148         CALL FIXLIN(ITMP,10)
  149     290 IF(LINBOD(11)) 300, 300, 295
  150     295 IFMT(4) = NFMT(2)
  151         DO 296 II=1,13
  152     296 ITMP(II)=snpr(II)+SIGN(.5,snpr(II))
  153         CALL FIXLIN(ITMP,11)
  154     300 IF(LINBOD(12)) 310, 310, 305
```

```
*************
                    Number of difference sections found: 7
                    Number of difference records  found: 38
```

OUTCOM.FOR

```
                    Number of difference sections found: 0
                    Number of difference records  found: 0
```

OUTGPH.FOR

```
                     Number of difference records found: 0
```

OUTION.FOR

```
*************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]OUTION.FOR;1
     5          COMMON /RON /CLAT (5), CLONG (5), GLAT (5), RD (5), FI (3, 5), YI
     6         1(3, 5), HI (3, 5), HPRIM (30, 3), HTRUE (30, 3), FVERT (30, 3), KM
     7         2, KFX, AFAC (30, 3), HNOR (3)
     8          DO 100 K=1,KFX
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]OUTION.FOR;1
     5          COMMON /RON /CLAT(5), CLONG(5), GLAT(5), RD(5), FI(3,5), YI(3,5),
     6         1HI(3,5), HPRIM(30,5), HTRUE(30,5), FVERT(30,5),KM,KFX, AFAC(30,5),
     7         2HTR(50), FNSQ(50)
     8          DO 100 K=1,KFX
*************
                    Number of difference sections found: 1
                    Number of difference records  found: 3
```

OUTKMF.FOR

```
                    Number of difference sections found: 0
                    Number of difference records  found: 0
```

OUTLAY.FOR

```
*************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]OUTLAY.FOR;1
    11          COMMON / TIME / IT, GMT, UTIME(24), GMTR, XLMT(24)
    12          IF(LINES - LINMAX) 110, 100, 100
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]OUTLAY.FOR;1
    11          COMMON / TIME / IT, GMT, UTIME(24), GMTR, XLMT(24), ITIM, JTX
    12          IF(LINES - LINMAX) 110, 100, 100
*************
                    Number of difference sections found: 1
                    Number of difference records  found: 1
```

OUTLIN.FOR

```
                     Number of difference records found: 0
```

OUTLNG.FOR

```
*************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]OUTLNG.FOR;1
     4          COMMON / DON / ALATD, AMIN, AMIND, BTR, BTRD, DLONG, DMP, ERTR,
     5         1 GCD, GCDKM, PMP, PWR, RLAT, RLATD, RLONG, RLONGD, RSN, SIGTR,
     6         2 TLAT, TLATD, TLONG, TLONGD, BRTD, FLUX, SSN, ATMNO
```

```
     7          COMMON / FRQ / FREL(29), FREQ, JMODE
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]OUTLNG.FOR;1
     4          COMMON /DON /ALATD, AMIN, AMIND, BTR, BTRD, DLONG, DMP, ERTR, GCD,
     5         1 GCDKM, PMP, PWR, RLAT, RLATD, RLONG, RLONGD, RSN, SIGTR, TLAT,
     6         2 TLATD,TLONG,TLONGD,BRTD,FLUX,SSN,D90R,D50R,D10R,D90S,D50S,D10S
     7          COMMON / FRQ / FREL(29), FREQ, JMODE
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]OUTLNG.FOR;1
    13         3 DELPEN(3,3)
    14          COMMON / LONG / DXMTR, DIKM, DTOP, DGRND, DRCVR, XLOSS, XLT, XLFG,
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]OUTLNG.FOR;1
    13         3 DELPEN(3,5)
    14          COMMON / LONG / DXMTR, DIKM, DTOP, DGRND, DRCVR, XLOSS, XLT, XLFG,
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]OUTLNG.FOR;1
    18          COMMON / TIME / IT, GMT, UTIME(24), GMTR, XLMT(24)
    19          IF(LUO.EQ.LU6) LOUT = LU16
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]OUTLNG.FOR;1
    18          COMMON / TIME / IT, GMT, UTIME(24), GMTR, XLMT(24), ITIM, JTX
    19          IF(LUO.EQ.LU6) LOUT = LU16
************
                    Number of difference sections found: 3
                    Number of difference records  found: 5
```

OUTMUF.FOR

```
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]OUTMUF.FOR;1
    14          COMMON / TIME / IT, GMT, UTIME(24), GMTR, XLMT(24)
    15          DIMENSION XFMT(5)
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]OUTMUF.FOR;1
    14          COMMON / TIME / IT, GMT, UTIME(24), GMTR, XLMT(24), ITIM, JTX
    15          DIMENSION XFMT(5)
************
                    Number of difference sections found: 1
                    Number of difference records  found: 1
```

OUTPAR.FOR

```
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]OUTPAR.FOR;1
     3    C      THIS ROUTINE OUTPUTS IONOSPHERIC PARAMETERS
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]OUTPAR.FOR;1
     3    C      STATEMENTS 501 AND 502 OF THIS SUBROUTINE HAVE BEEN MODIFIED
     4    C      TO REDUCE OUTPUT LINES TO 132 OR FEWER CHARACTERS AND THUS
     5    C      PRINTABLE ON THE SSDVAX LINE PRINTER
     6    C      MARK DAEHLER, 24 OCTOBER 1985
     7    C
     8    C
     9    C      THIS ROUTINE OUTPUTS IONOSPHERIC PARAMETERS
************
************
```

OUTPAR.FOR (cont'd.)

```
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]OUTPAR.FOR;1
     6          COMMON / DON / ALATD, AMIN, AMIND, BTR, BTRD, DLONG, DMP, ERTR,
     7         1 GCD, GCDKM, PMP, PWR, RLAT, RLATD, RLONG, RLONGD, RSN, SIGTR,
     8         2 TLAT, TLATD, TLONG, TLONGD, BRTD, FLUX, SSN, ATMNO
     9          COMMON / ES / FS(3,5), HS(5)
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]OUTPAR.FOR;1
    12          COMMON /DON /ALATD, AMIN, AMIND, BTR, BTRD, DLONG, DMP, ERTR, GCD,
    13         1 GCDKM, PMP, PWR, RLAT, RLATD, RLONG, RLONGD, RSN, SIGTR, TLAT,
    14         2 TLATD,TLONG,TLONGD,BRTD,FLUX,SSN,D90R,D50R,D10R,D90S,D50S,D10S
    15          COMMON / ES / FS(3,5), HS(5)
*************
*************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]OUTPAR.FOR;1
    17          COMMON / RON / CLAT(5), CLONG(5), GLAT(5), RD(5), FI(3,5), YI(3,5)
    18         1 , HI(3,5), HPRIM(30,3), HTRUE(30,3), FVERT(30,3), KM, KFX,
    19         2 AFAC(30,3), HNOR(3), FX(3,5), HTR(50), FNSQ(50)
    20          COMMON / TIME / IT, GMT, UTIME(24)
    21          COMMON / FILES / LUI, LUO, LU2, LU5, LU6, LU15, LU16, LU20, LU25,
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]OUTPAR.FOR;1
    23          COMMON /RON /CLAT(5), CLONG(5), GLAT(5), RD(5), FI(3,5), YI(3,5),
    24         1HI(3,5), HPRIM(30,5), HTRUE(30,5), FVERT(30,5),KM,KFX, AFAC(30,5),
    25         2HTR(50), FNSQ(50)
    26          COMMON / TIME / IT, GMT, UTIME(24), GMTR, XLMT(24), ITIM, JTX
    27          COMMON / FILES / LUI, LUO, LU2, LU5, LU6, LU15, LU16, LU20, LU25,
*************
*************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]OUTPAR.FOR;1
    56         A 'Y1',5X,'H1',3X,'FH/2',3X,'F2Z',4X,'Y2',5X,'H2',4X,'ES',3X,'MED',
    57         B 4X,'HI',1X,'M3000',3X,'HPF2',3X,'RAT',4X,'ZEN',2X,'ZMAX',3X,
    58         C 'MAGL')
    59       502 FORMAT(' ',F5.1,A1,1X,F5.1,A1,2F6.1,F6.2,2F6.1,2F7.1,2F6.1,F7.1,
    60         1 3F6.1,F6.2,F7.1,F6.1,F7.1,F6.1,F7.1,A1)
    61       503 FORMAT(' ')
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]OUTPAR.FOR;1
    62    C    A 'Y1',5X,'H1',3X,'FH/2',3X,'F2Z',4X,'Y2',5X,'H2',4X,'ES',3X,'MED',
    63    C    B 4X,'HI',1X,'M3000',3X,'HPF2',3X,'RAT',4X,'ZEN',2X,'ZMAX',3X,
    64    C    C 'MAGL')
    65         A 'Y1',5X,'H1',2X,'FH/2',3X,'F2Z',4X,'Y2',5X,'H2',3X,'ES',2X,'MED',
    66         B 3X,'HI',1X,'M3000',3X,'HPF2',3X,'RAT',4X,'ZEN',2X,'ZMAX',2X,
    67         C 'MAGL')
    68       502 FORMAT(' ',F5.1,A1,1X,F5.1,A1,2F6.1,F6.2,2F6.1,F7.1,3F6.1,F7.1,
    69         1 3F5.1,F6.2,F7.1,F6.1,F7.1,F6.1,F6.1,A1)
    70       503 FORMAT(' ')
*************
                    Number of difference sections found: 4
                    Number of difference records  found: 21
```

OUTTAB.FOR

```
*************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]OUTTAB.FOR;1
    10         A DBLOSL(13), DBLOSU(13), DBU(13), DELAY(13), NDBW(13), NHP(13),
    11         B NYNOIS(13), PROBMP(13), RELIAB(13), SNDB(13), SNPR(13),
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]OUTTAB.FOR;1
    10         A DBLOSL(13), DBLOSU(13), DBU(13), DELAY(13), DBW(13), NHP(13),
    11         B NYNOIS(13), PROBMP(13), RELIAB(13), SNDB(13), SNPR(13),
```

```
************
                    Number of difference sections found: 1
                    Number of difference records  found: 1
```

OUTTOP.FOR

```
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]OUTTOP.FOR;1
   23         A ),YND(3,2),YNL(3,2),YNH(3,2),TEY(3,4,2)
   24          COMMON/CON/D2R,DCL,GAMA,PI,PI2,PIO2,R2D,RZ,VOFL
   25          COMMON/DON/ALATD,AMIN,AMIND,BTR,BTRD,DLONG,DMP,ERTR,GCD,GCDKM,PMP
   26         A ,PWR,RLAT,RLATD,RLONG,RLONGD,RSN,SIGTR,TLAT,TLATD,TLONG,TLONGD
   27         B ,BRTD,FLUX,SSN,ATMNO
   28          COMMON / FILES / LUI, LUO, LU2, LU5, LU6, LU15, LU16, LU20, LU25,
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]OUTTOP.FOR;1
   23         A ),YND(3,2),YNL(3,2),YNH(3,2),TEY(3,4,2),toaz(3,2)
   24          COMMON/CON/D2R,DCL,GAMA,PI,PI2,PIO2,R2D,RZ,VOFL
   25          COMMON /DON /ALATD, AMIN, AMIND, BTR, BTRD, DLONG, DMP, ERTR, GCD,
   26         1 GCDKM, PMP, PWR, RLAT, RLATD, RLONG, RLONGD, RSN, SIGTR, TLAT,
   27         2 TLATD,TLONG,TLONGD,BRTD,FLUX,SSN,D90R,D50R,D10R,D90S,D50S,D10S
   28          COMMON / FILES / LUI, LUO, LU2, LU5, LU6, LU15, LU16, LU20, LU25,
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]OUTTOP.FOR;1
   33          COMMON / METSET / VERSN, ITRUN, ITOUT, JTRUN(40), JTOUT(40)
   34          COMMON / OUTPRT / LINBOT(30), LINBD(14), LINTOP(15), LINTP(14),
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]OUTTOP.FOR;1
   33          COMMON / METSET / VERSN, ITRUN, ITOUT, JTRUN(40), JTOUT(40), LSEAS
   34          COMMON / OUTPRT / LINBOT(30), LINBD(14), LINTOP(15), LINTP(14),
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]OUTTOP.FOR;1
   39          COMMON/TON/ADJ,ADS,ATMO,GNOS,GOT,PWRDB,RCNSE,REL,SL,SLS,SPR,SU,SUS
   40         A ,TIMER,XADJN,XEFF,XNOISE,XTLOS,ZNOISE,NF
   41          DIMENSION XFRQB(2)
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]OUTTOP.FOR;1
   39          COMMON/TON/ADJ,ADS,GNOS,GOT,PWRDB,REL,SL,SLS,SPR,SU,SUS
   40         A ,XNOISE,ZNOISE,NF
   41          DIMENSION XFRQB(2)
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]OUTTOP.FOR;1
  131     1500 FORMAT('1',32X,'METHOD',I3,3X,'IONCAP ',F5.2,3X,'PAGE',I4,/)
  132     1502 FORMAT(' ',12X,A3,3X,A5,10X,'SSN = ',F4.0)
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]OUTTOP.FOR;1
  131     1500 FORMAT(1H1,32X,'METHOD',I3,3X,'IONCAP ',F5.2,3X,'PAGE',I4,/)
  132     1502 FORMAT(' ',12X,A3,3X,A5,10X,'SSN = ',F4.0)
************
                    Number of difference sections found: 4
                    Number of difference records  found: 9
```

PEN.FOR

```
*************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]PEN.FOR;1
     5          COMMON/RON/CLAT(5),CLONG(5),GLAT(5),RD(5),FI(3,5),YI(3,5),HI(3,5)
     6          X = F/FI(I,K)
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]PEN.FOR;1
     5          COMMON /RON /CLAT(5), CLONG(5), GLAT(5), RD(5), FI(3,5), YI(3,5),
     6         1HI(3,5), HPRIM(30,5), HTRUE(30,5), FVERT(30,5),KM,KFX, AFAC(30,5),
     7         2HTR(50), FNSQ(50)
     8          X = F/FI(I,K)
*************
                    Number of difference sections found: 1
                    Number of difference records  found: 3
```

PENANG.FOR

```
*************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]PENANG.FOR;1
    10         3,  DELPEN(3,3)
    11          COMMON /MODES /GHOP, DELMOD (6, 3), HPMOD (6, 3), HTMOD (6, 3), FV
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]PENANG.FOR;1
    10         3,  DELPEN(3,5)
    11          COMMON /MODES /GHOP, DELMOD (6, 3), HPMOD (6, 3), HTMOD (6, 3), FV
*************
*************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]PENANG.FOR;1
    14          COMMON /RON /CLAT (5), CLONG (5), GLAT (5), RD (5), FI (3, 5), YI
    15         1(3, 5), HI (3, 5), HPRIM (30, 3), HTRUE (30, 3), FVERT (30, 3), KM
    16         2, KFX, AFAC (30, 3), HNOR (3)
    17          COMMON / FRQ / FREL(29), FREQ
    18          FMHZ = FREQ
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]PENANG.FOR;1
    14          COMMON /RON /CLAT(5), CLONG(5), GLAT(5), RD(5), FI(3,5), YI(3,5),
    15         1HI(3,5), HPRIM(30,5), HTRUE(30,5), FVERT(30,5),KM,KFX, AFAC(30,5),
    16         2HTR(50), FNSQ(50)
    17          COMMON / FRQ / FREL(29), FREQ, JMODE
    18          FMHZ = FREQ
*************
                    Number of difference sections found: 2
                    Number of difference records  found: 5
```

PRBMUF.FOR

```
*************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]PRBMUF.FOR;1
     1          FUNCTION PRBMUF(FMHZ,FGO,FSET,IL)
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]PRBMUF.FOR;1
     1
     2          FUNCTION PRBMUF(FMHZ,FGO,FSET,IL)
*************
                    Number of difference sections found: 1
                    Number of difference records  found: 1
```

REDMAP.FOR

```
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]REDMAP.FOR;1
     8        1 GCDKM, PMP, PWR, RLAT, RLATD, RLONG, RLONGD, RSN, SIGTR, TLAT, TL
     9        2ATD, TLONG, TLONGD, BRTD, FLUX, SSN, ATMNO
    10         COMMON / FILES / LUI, LUO, LU2, LU5, LU6, LU15, LU16, LU20, LU25,
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]REDMAP.FOR;1
     8        1 GCDKM, PMP, PWR, RLAT, RLATD, RLONG, RLONGD, RSN, SIGTR, TLAT,
     9        2 TLATD,TLONG,TLONGD,BRTD,FLUX,SSN,D90R,D50R,D10R,D90S,D50S,D10S
    10         COMMON / FILES / LUI, LUO, LU2, LU5, LU6, LU15, LU16, LU20, LU25,
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]REDMAP.FOR;1
    20         COMMON / RAYS / ANG(40), IFOB(40,30,3), NANG
    21         COMMON / REFLX / DELFX(45,3), HPFLX(45,3), HTFLX(45,3),
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]REDMAP.FOR;1
    20         COMMON / RAYS / ANG(40), IFOB(40,30,5), NANG
    21         COMMON / REFLX / DELFX(45,3), HPFLX(45,3), HTFLX(45,3),
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]REDMAP.FOR;1
    24        C DELPEN(3,3)
    25         COMMON / SSP / SUN(2,12), MONTH
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]REDMAP.FOR;1
    24        C DELPEN(3,5)
    25         COMMON / SSP / SUN(2,12), MONTH
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]REDMAP.FOR;1
    35    C.....EQUIVALENCE ALL DATA FILE VARIABLES TO IFOB(40,30,3)
    36         EQUIVALENCE(STOCOF(1), IFOB(1,1,1))
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]REDMAP.FOR;1
    35    C.....EQUIVALENCE ALL DATA FILE VARIABLES TO IFOB(40,30,5)
    36         EQUIVALENCE(STOCOF(1), IFOB(1,1,1))
************
                    Number of difference sections found: 4
                    Number of difference records  found: 5
```

REGMOD.FOR

```
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]REGMOD.FOR;1
     6    C
     7         COMMON/ANOIS/ATNU,ATNY,CC,TM,XEFF,RCNSE,DU,DL,SIGM,SXGU,SXGL,KJ,JK
     8         COMMON /SSP /SUN (2, 12), MONTH
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]REGMOD.FOR;1
     6    c
     7         COMMON / CONTRL / IELECT(3), KTOUT(12), MONTHS(12), SUNSP(12),
     8        A IANTOU, ICARD, INTEG, IRED, ISOUT, ISPROC, ISSN, ITYPE, JDASH,
     9        B JFREQ, JLONG, KCARD, KRUN, MAPIN, MAXNAM, MONOLD, MOREM, MORES,
    10        C NUMNAM, NUPROC, MAXMET, mspec, m100
    11         COMMON/ANOIS/ATNU,ATNY,CC,TM,RCNSE,DU,DL,SIGM,SXGU,SXGL,KJ,JK
    12         COMMON /SSP /SUN (2, 12), MONTH
************
************
```

```
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]REGMOD.FOR;1
   17         1 GCDKM, PMP, PWR, RLAT, RLATD, RLONG, RLONGD, RSN, SIGTR, TLAT, TL
   18         2ATD, TLONG, TLONGD, BRTD, FLUX, SSN, ATMNO
   19          COMMON /RON /CLAT (5), CLONG (5), GLAT (5), RD (5), FI (3, 5), YI
   20         1(3, 5), HI (3, 5), HPRIM (30, 3), HTRUE (30, 3), FVERT (30, 3), KM
   21         B,KFX,AFAC(30,3),HNOR(3),FX(3,5)
   22          COMMON /RTANT /XETA, XSIG, XEPS, XND, XNL, XNH, TEX (4), ITANT, IR
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]REGMOD.FOR;1
   21         1 GCDKM, PMP, PWR, RLAT, RLATD, RLONG, RLONGD, RSN, SIGTR, TLAT,
   22         2 TLATD,TLONG,TLONGD,BRTD,FLUX,SSN,D90R,D50R,D10R,D90S,D50S,D10S
   23          COMMON /RON /CLAT(5), CLONG(5), GLAT(5), RD(5), FI(3,5), YI(3,5),
   24         1HI(3,5), HPRIM(30,5), HTRUE(30,5), FVERT(30,5),KM,KFX, AFAC(30,5),
   25         2HTR(50), FNSQ(50)
   26          COMMON /RTANT /XETA, XSIG, XEPS, XND, XNL, XNH, TEX (4), ITANT, IR
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]REGMOD.FOR;1
   25         1HN (7), HP (7), PROB (7), RELY (7), RGAIN (7), SIGPOW (7), SN (7),
   26         2 SPRO (7), TGAIN (7), TIMED (7), TLOSS (7), B (7), FSLOS (7), ADV
   27         C (7),OBF(7),NMODE(7),NPROB,NREL,TLLOW(7),TLHGH(7)
   28          COMMON/TON/ADJ,ADS,ATMO,GNOS,GOT,PWRDB,XCNSE,REL,SL,SLS
   29         A ,SPR,SU,SUS,TIMER,XADJN,ZEFF,XNOISE,XTLOS,ZNOISE,NF
   30          COMMON / FRQ / FREL(29), FREQ, JMODE
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]REGMOD.FOR;1
   29         1 HN(7), HP(7), PROB(7), RELY(7), RGAIN(7), SIGPOW(7), SN(7),
   30         2 SPRO(7), TGAIN(7), TIMED(7), TLOSS(7), B(7), FSLOS(7), ADV(7),
   31         3 OBF(7),NMODE(7),TLLOW(7),TLHGH(7)
   32          COMMON/TON/ADJ,ADS,GNOS,GOT,PWRDB,REL,SL,SLS
   33         A ,SPR,SU,SUS,XNOISE,ZNOISE,NF
   34          COMMON / FRQ / FREL(29), FREQ, JMODE
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]REGMOD.FOR;1
   39          COMMON / RAYS / ANG(40), IFOB(40,30,3), NANG
   40          COMMON /TIME /IT, GMT, UTIME (24)
   41          DIMENSION LX(3)
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]REGMOD.FOR;1
   43          COMMON / RAYS / ANG(40), IFOB(40,30,5), NANG
   44          COMMON / TIME / IT, GMT, UTIME(24), GMTR, XLMT(24), ITIM, JTX
   45          DIMENSION LX(3)
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]REGMOD.FOR;1
   45    C  TEMPORARILY FILL  A SELECTED MODES INTO COMMON/ZON/
   46    C  SHOULD DO THIS BY A EQUAL TAKEOFF ANGLE SEARCH IN COMMON/REFLX/
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]REGMOD.FOR;1
   49    C  TEMPORARILY FILL  A SELECTED MODES INTO COMMON/ZON
   50    C  SHOULD DO THIS BY A EQUAL TAKEOFF ANGLE SEARCH IN COMMON/REFLX/
************
************
```

```
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]REGMOD.FOR;1
   79   C.....BEGINNING OF PRESET OF COMMON/ZON/
   80          DO 240 IM = 1,7
   81          ITRY =1
   82      100 CONTINUE
   83          OBF(IM) = 1000.
   84          ADV(IM) = 1000.
   85          FSLOS(IM)=1000.
   86          TLOSS(IM)=1000.
   87          ABPS(IM) =1000.
   88          EFF(IM)  = 0.0
   89          GRLOS(IM)=1000.
   90          RGAIN(IM)=  0.0
   91          TGAIN(IM)=  0.0
   92          HN(IM) = -1.
   93          PROB(IM) = 0.001
   94          CREL(IM) = 0.001
   95          RELY(IM) = 0.001
   96          SPRO(IM) = 0.001
   97          FLDST(IM) = -1000.0
   98          SIGPOW(IM)=-1000.
   99          SN(IM)=-1000.
  100          TIMED(IM) = -1.
  101          HP   (IM) = -1.
  102          B    (IM) = -1.
  103          NMODE(IM) = 5
  104          TLLOW(IM) = 10.
  105          TLHGH(IM) = 10.
  106   C.....ENDING OF PRESET OF COMMON/ZON/
  107          IF(IM -7 ) 101,240,240
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]REGMOD.FOR;1
   83          DO 240 IM = 1,7
   84          ITRY =1
   85   C.....PRESET IN COMMON/ZON/
   86          HN(IM) = -1.
   87          HP   (IM) = -1.
   88          IF(IM -7 ) 101,240,240
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]REGMOD.FOR;1
  209   C.....GAIN AT TRANSMITTER
  210          CALL GAIN(1,KASANT,DEL,FREQ,DUMMY,TEFF)
  211          TGAIN(IM) = DUMMY
  212    195   CONTINUE
  213   C.....GAIN AT RECEIVER
  214          CALL GAIN(2,KASANT,DEL,FREQ,DUMMY1,DUMMY2)
  215          RGAIN(IM) = DUMMY1
  216          EFF(IM) = DUMMY2
  217    200   CONTINUE
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]REGMOD.FOR;1
  190          if(mspec.ne.125)then
  191   C.......GAIN AT TRANSMITTER
  192            CALL GAIN(1,KASANT,DEL,FREQ,DUMMY,TEFF)
  193            TGAIN(IM) = DUMMY
  194   C.......GAIN AT RECEIVER
  195            CALL GAIN(2,KASANT,DEL,FREQ,DUMMY1,DUMMY2)
```

REGMOD.FOR (cont'd.)

```
  196           RGAIN(IM) = DUMMY1
  197           EFF(IM) = DUMMY2
  198         else
  199   c.......set gains and eff to 0. dB or unity
  200           tgain(im)=0.
  201           rgain(im)=0.
  202           eff(im)=0.
  203         endif
  204    200  CONTINUE
************
                  Number of difference sections found: 7
                  Number of difference records  found: 61
```

RELBIL.FOR

```
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]RELBIL.FOR;1
   33          COMMON / ALPHA / IMON(12), IRCVR(2), ITRAN(2), MODE(13),
   34         A MODER(13), MODVHF(13), IRLAT, IRLONG, ITLAT, ITLONG, NYEAR
   35          COMMON/ANOIS/ATNU,ATNY,CC,TM,XEFF,RCNSE,DU,DL,SIGM,SXGU,SXGL,KJ,JK
   36          COMMON /CON /D2R, DCL, GAMA, PI, PI2, PIO2, R2D, RZ, VOFL
   37          COMMON /DON /ALATD, AMIN, AMIND, BTR, BTRD, DLONG, DMP, ERTR, GCD,
   38         1 GCDKM, PMP, PWR, RLAT, RLATD, RLONG, RLONGD, RSN, SIGTR, TLAT, TL
   39         2ATD,TLONG,TLONGD,BRTD,FLUX,SSN,ATMNO,D90R,D50R,D10R,D90S,D50S,D10S
   40          COMMON / FRQ / FREL(29), FREQ
   41          COMMON / ION / IANT(3,2), NTR(2), IEA, IFQB, IFQE, IGRAPH, IHRE,
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]RELBIL.FOR;1
   33    c
   34          COMMON / CONTRL / IELECT(3), KTOUT(12), MONTHS(12), SUNSP(12),
   35         A IANTOU, ICARD, INTEG, IRED, ISOUT, ISPROC, ISSN, ITYPE, JDASH,
   36         B JFREQ, JLONG, KCARD, KRUN, MAPIN, MAXNAM, MONOLD, MOREM, MORES,
   37         C NUMNAM, NUPROC, MAXMET, mspec, m100
   38          COMMON / ALPHA / IMON(12), IRCVR(2), ITRAN(2), MODE(13),
   39         A MODER(13), MODVHF(13), IRLAT, IRLONG, ITLAT, ITLONG, NYEAR
   40          COMMON/ANOIS/ATNU,ATNY,CC,TM,RCNSE,DU,DL,SIGM,SXGU,SXGL,KJ,JK
   41          COMMON /CON /D2R, DCL, GAMA, PI, PI2, PIO2, R2D, RZ, VOFL
   42          COMMON /DON /ALATD, AMIN, AMIND, BTR, BTRD, DLONG, DMP, ERTR, GCD,
   43         1 GCDKM, PMP, PWR, RLAT, RLATD, RLONG, RLONGD, RSN, SIGTR, TLAT,
   44         2 TLATD,TLONG,TLONGD,BRTD,FLUX,SSN,D90R,D50R,D10R,D90S,D50S,D10S
   45          COMMON / FRQ / FREL(29), FREQ, JMODE
   46          COMMON / ION / IANT(3,2), NTR(2), IEA, IFQB, IFQE, IGRAPH, IHRE,
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]RELBIL.FOR;1
   44          COMMON / METSET / VERSN, ITRUN, ITOUT, JTRUN(40), JTOUT(40)
   45          COMMON/MUFS/EMUF(24),FIMUF(24),F2MUF(24),ESMUF(24),ALLMUF(24),FOT
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]RELBIL.FOR;1
   49          COMMON / METSET / VERSN, ITRUN, ITOUT, JTRUN(40), JTOUT(40), LSEAS
   50          COMMON/MUFS/EMUF(24),FIMUF(24),F2MUF(24),ESMUF(24),ALLMUF(24),FOT
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]RELBIL.FOR;1
   54         A DBLOSL(13), DBLOSU(13), DBU(13), DELAY(13), NDBW(13), NHP(13),
   55         B NYNOIS(13), PROBMP(13), RELIAB(13), SNDB(13), SNPR(13),
   56         C SNRLW(13), SNRUP(13), SPROB(13), VHIGH(13)
```

```
   57          COMMON /TON /ADJ, ADS, ATMO, GNOS, GOT, PWRDB, ZCNSE, REL, SL, SLS
   58         1, SPR, SU, SUS, TIMER, XADJN, ZEFF, XNOISE, XTLOS, ZNOISE, NF
   59          COMMON / ZON / ABPS(7), CREL(7), EFF(7), FLDST(7), GRLOS(7),
   60         1HN (7), HP (7), PROB (7), RELY (7), RGAIN (7), SIGPOW (7), SN (7),
   61         2 SPRO (7), TGAIN (7), TIMED (7), TLOSS (7), B (7), FSLOS (7), ADV
   62         C(7),OBF(7),NMODE(7),NPROB,NREL,TLLOW(7),TLHGH(7)
   63          DIMENSION TME(10)
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]RELBIL.FOR;1
   59         A DBLOSL(13), DBLOSU(13), DBU(13), DELAY(13), DBW(13), NHP(13),
   60         B NYNOIS(13), PROBMP(13), RELIAB(13), SNDB(13), SNPR(13),
   61         C SNRLW(13), SNRUP(13), SPROB(13), VHIGH(13)
   62          COMMON /TON /ADJ, ADS, GNOS, GOT, PWRDB, REL, SL, SLS
   63         1, SPR, SU, SUS, XNOISE, ZNOISE, NF
   64          COMMON / allMODE /ABPS(20),CREL(20),FLDST(20),HN(20),HP(20),
   65         1PROB(20),RELY(20),RGAIN(20),SIGPOW(20),SN(20),
   66         2SPRO(20),TGAIN(20),TIMED(20),TLOSS(20),B(20),FSLOS(20),
   67         CNMODE(20),TLLOW(20),TLHGH(20),EFF(20),NREL,NMMOD
   68          DIMENSION TME(10)
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]RELBIL.FOR;1
   72          D50R = RSN
   73          D10R = 20.
   74           D90R = 20.
   75    C.....BEGINNING OF RELIABILITY CALCULATION FOR EACH MODE
   76    C
   77    C.....USED TO SELECT 1 OF UP TO 6 MODES FOR EACH HOP
   78    C.....ON THE LAST CALL THE MOST RELIABLE WILL BE OUTPUT
   79          DO 310 IM = 1,6
   80          IF( HP(IM) - 70. ) 105,105,110
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]RELBIL.FOR;1
   77    C.............................................
   78          INUM=NMMOD
   79    C.....IF NO MODES RETURN.....................................................
   80          IF(INUM.LE.0)RETURN
   81    C.....BEGINNING OF RELIABILITY CALCULATION FOR EACH MODE
   82    C.....USED TO SELECT 1 OF UP TO 20 MODES FOR EACH FREQ
   83          DU2=DU*DU
   84          DL2=DL*DL
   85          DO 310 IM = 1,INUM
   86          IF( HP(IM) - 70. ) 105,105,110
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]RELBIL.FOR;1
   87    C  REQUIRED SIGNAL TO NOISE DISTRIBUTION
   88      286 D10R = SQRT(DL*DL + DSLF*DSLF)
   89          D50R =  SN(IM)
   90           D90R = SQRT( DU*DU + DSUF*DSUF )
   91          Z =  RSN - D50R
   92           IF( Z ) 290,290,295
   93      290 Z = Z/( D10R/1.28)
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]RELBIL.FOR;1
   93    C.....REQUIRED SIGNAL TO NOISE DISTRIBUTION
   94          D10R = SQRT(DL2 + DSLF*DSLF)
   95          D50R =  SN(IM)
```

```
   96          D90R = SQRT( DU2 + DSUF*DSUF )
   97          Z =  RSN - D50R
   98          IF( Z ) 290,290,295
   99      290 Z = Z/( D10R/1.28)
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]RELBIL.FOR;1
  108           JIN = 1
  109          DO 140 IM= 2,6
  110          IF( HP(IM) ) 140,140,118
  111      118 CONTINUE
  112          JIN = JIN +1
  113    C.....MAKE SELECTION BASED ON RELIABILITY FIRST BUT IF CLOSE SELECT ON
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]RELBIL.FOR;1
  114    C.....IF ONLY ONE MODE USE IT.....................................
  115          IF(INUM.EQ.1)GO TO 145
  116          DO 140 IM= 2,INUM
  117    C.....MAKE SELECTION BASED ON RELIABILITY FIRST BUT IF CLOSE SELECT ON
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]RELBIL.FOR;1
  116          IF( ABS(RELY(IM) - XREL) - XEPS ) 120,120,135
  117      120 IF(ABS(XHN - HN(IM)) - XEPS) 125, 125, 121
  118      121 IF(XHN - HN(IM)) 140, 125, 130
  119      125 IF( XSN - SN(IM) ) 130,140,140
  120      130 IR = IM
  121          XHN=HN(IM)
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]RELBIL.FOR;1
  120          IF( ABS(RELY(IM) - XREL).LE.XEPS )THEN
  121    C.......CLOSE SO TEST IF NUMBER OF HOPS ARE EQUAL.....................
  122            IF(ABS(XHN - HN(IM)).LE.XEPS)THEN
  123    C.........NUMBER OF HOPS ARE EQUAL SO TEST MEDIAN SNR.................
  124              IF( XSN.LT.SN(IM) )GO TO 139
  125            ELSE IF(XHN.GT.HN(IM))THEN
  126    C.........THIS ONE HAS FEWER HOPS.....................................
  127              GO TO 139
  128            ENDIF
  129          ELSE IF(RELY(IM).GT.XREL)THEN
  130    C.......THIS ONE IS MORE RELIABLE TRY IT..............................
  131            GO TO 139
  132          ENDIF
  133          GO TO 140
  134    C.....THIS MODE IS BETTER SO TRY IT...................................
  135      139 IR = IM
  136          XHN=HN(IM)
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]RELBIL.FOR;1
  124          GO TO 140
  125      135 IF(RELY(IM)-XREL) 140,120,130
  126      140 CONTINUE
  127          IF( HP(IR) ) 355,355,145
  128      145 CONTINUE
```

```
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]RELBIL.FOR;1
  139      140 CONTINUE
  140      145 CONTINUE
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]RELBIL.FOR;1
  131          NPROB = IR
  132          IF ( JIN-1 ) 360,360,365
  133      360 RELIAB(IF) = RELY(IR)
  134          DBLOSL(IF) = TLLOW(IR)
  135          DBLOSU(IF) = TLHGH(IR)
  136          DBU(IF) = FLDST(IR)
  137          SNDB(IF) = SN(IR)
  138          NDBW(IF) = SIGPOW(IR)
  139          GO TO 372
  140      365 CONTINUE
  141    C  ADD THE SIGNALS (RANDOM PHASE APPROXIMATION = ADD THE POWERS IN WATTS
  142          XDSLW = 0.0
  143           XSIGS = 0.0
  144          XDSUP = 0.0
  145          XFLD = 0.
  146          DO 370 IM = 1,6
  147          IF( HP(IM) ) 370,370,366
  148      366 ZEXP = .1*(SIGPOW(IM) - TLLOW(IM) )
  149          ZEXP = AMAX1 (ZEXP,  -100. )
  150           XDSLW = XDSLW + 10. ** ZEXP
  151           ZEXP = .1*SIGPOW(IM)
  152          ZEXP = AMAX1 (ZEXP,  -100. )
  153          XSIGS = XSIGS +10. ** ZEXP
  154          ZEXP = .1 * (SIGPOW(IM) + TLHGH(IM))
  155          ZEXP = AMAX1 (ZEXP,  -100. )
  156          XDSUP = XDSUP + 10. ** ZEXP
  157    C  MUST DO FIELD STRENGTH SEPARATE  BECAUSE OF RECEIVE ANTENNA
  158          ZEXP = .1*FLDST(IM)
  159          ZEXP = AMAX1(ZEXP,-100.)
  160          XFLD = XFLD + 10.**ZEXP
  161      370 CONTINUE
  162          SIGMED = 4.343*ALOG(XSIGS)
  163          DBLOSL(IF) = ABS( SIGMED - 4.343*ALOG(XDSLW) )
  164          DBLOSU(IF) = ABS( 4.343*ALOG(XDSUP) - SIGMED )
  165          NDBW(IF) = SIGMED
  166          DELSIG = SIGMED - SIGPOW(IR)
  167          DBU(IF) = 4.343*ALOG(XFLD)
  168           SNDB(IF) = SN(IR) + DELSIG
  169      372 CONTINUE
  170    C  REDO RELIABILITY FOR SUM OF MODES
  171          D10R = SQRT( DL*DL + DBLOSL(IF)*DBLOSL(IF) )
  172          D50R = SNDB(IF)
  173          D90R = SQRT( DU*DU + DBLOSU(IF)*DBLOSU(IF) )
  174          SNRLW(IF) = D10R
  175          SNRUP(IF) = D90R
  176          Z = RSN - D50R
  177          IF( Z ) 375,375,380
  178      375 Z = Z/(D10R/1.28)
  179          GO TO 385
  180      380 Z = Z/(D90R/1.28)
  181      385 RELIAB(IF) = 1. - FNORML(Z)
  182          ANGLE(IF) =  B(IR)
```

```
  183          CPROB (IF)= PROB (IR)
  184          DBLOS (IF)= TLOSS(IR)
  185          DELAY (IF)= TIMED(IR)
  186          VHIGH (IF)= HP   (IR)
  187          MODE  (IF)= LAYTYP(IS)
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]RELBIL.FOR;1
  143          IF(INUM.eq.1)THEN
  144    C.....ONLY ONE MODE SO SET MOST RELIABLE VALUES.....................
  145            RELIAB(IF) = RELY(IR)
  146            DBLOSL(IF) = TLLOW(IR)
  147            DBLOSU(IF) = TLHGH(IR)
  148            DBU(IF) = FLDST(IR)
  149            SNDB(IF) = SN(IR)
  150            DBW(IF) = SIGPOW(IR)
  151          ELSE
  152    C.....ADD THE SIGNALS RANDOM PHASE i.e. ADD THE POWERS IN WATTS....
  153            XDSLW = 0.0
  154            XSIGS = 0.0
  155            XDSUP = 0.0
  156            XFLD = 0.
  157            DXSIGS=-1000.
  158            DXFLD=-1000.
  159            DXDSLW=-1000.
  160            DXDSUP=-1000.
  161            DO 369 IV=1,INUM
  162            DXSIGS=AMAX1(DXSIGS,SIGPOW(IV))
  163            DXFLD=AMAX1(DXFLD,FLDST(IV))
  164            DXDSLW=AMAX1(DXDSLW,SIGPOW(IV)-TLLOW(IV))
  165            DXDSUP=AMAX1(DXDSUP,SIGPOW(IV)+TLHGH(IV))
  166      369   CONTINUE
  167            DO 370 IM = 1,INUM
  168            ZEXP = .1*(SIGPOW(IM) - TLLOW(IM)-DXDSLW)
  169            XDSLW = XDSLW + 10. ** ZEXP
  170            ZEXP = .1*(SIGPOW(IM)-DXSIGS)
  171            XSIGS = XSIGS +10. ** ZEXP
  172            ZEXP = .1 * (SIGPOW(IM) + TLHGH(IM)-DXDSUP)
  173            XDSUP = XDSUP + 10. ** ZEXP
  174    C  MUST DO FIELD STRENGTH SEPARATE  BECAUSE OF RECEIVE ANTENNA
  175            ZEXP = .1*(FLDST(IM)-DXFLD)
  176            XFLD = XFLD + 10.**ZEXP
  177      370   CONTINUE
  178            SIGMED = DXSIGS+ 4.343*ALOG(XSIGS)
  179            DBLOSL(IF) = ABS( SIGMED - 4.343*ALOG(XDSLW)-DXDSLW )
  180            DBLOSU(IF) = ABS( DXDSUP+4.343*ALOG(XDSUP) - SIGMED )
  181            DBW(IF) = SIGMED
  182            DELSIG = SIGMED - SIGPOW(IR)
  183            DBU(IF) = DXFLD + 4.343*ALOG(XFLD)
  184            SNDB(IF) = SN(IR) + DELSIG
  185    C.....REDO RELIABILITY FOR SUM OF MODES.............................
  186            D10R = SQRT( DL2 + DBLOSL(IF)*DBLOSL(IF) )
  187            D50R = SNDB(IF)
  188            D90R = SQRT( DU2 + DBLOSU(IF)*DBLOSU(IF) )
  189            Z = RSN - D50R
  190            IF( Z ) 375,375,380
  191      375   Z = Z/(D10R/1.28)
  192            GO TO 385
  193      380   Z = Z/(D90R/1.28)
```

RELBIL.FOR (cont'd.)

```
  194      385   RELIAB(IF) = 1. - FNORML(Z)
  195          ENDIF
  196          SNRLW(IF) = D10R
  197          SNRUP(IF) = D90R
  198          ANGLE(IF) =  B(IR)
  199          VHIGH(IF)=HP(IR)
  200          DELAY(IF)=TIMED(IR)
  201          DBLOS (IF)= TLOSS(IR)
  202          CPROB(IF)=PROB(IR)
  203          MODE  (IF)= LAYTYP(IS)
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]RELBIL.FOR;1
  190          XEFF = EFF(1)
  191          ZEFF = EFF(1)
  192    C  REQUIRED POWER GAIN  FOR SPECIFIED RELIABILITY.
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]RELBIL.FOR;1
  206    C  REQUIRED POWER GAIN  FOR SPECIFIED RELIABILITY.
************
                    Number of difference sections found: 10
                    Number of difference records  found: 125
```

SANG.FOR

```
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]SANG.FOR;1
    7          COMMON/RAYS/ANG(40),IFOB(40,30,3),NANG
    8          COMMON /DON /ALATD, AMIN, AMIND, BTR, BTRD, DLONG, DMP, ERTR, GCD,
    9         1 GCDKM, PMP, PWR, RLAT, RLATD, RLONG, RLONGD, RSN, SIGTR, TLAT, TL
   10         2ATD, TLONG, TLONGD, BRTD, FLUX, SSN, ATMNO
   11          DIMENSION NANGX(8)
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]SANG.FOR;1
    7          COMMON/RAYS/ANG(40),IFOB(40,30,5),NANG
    8          COMMON /DON /ALATD, AMIN, AMIND, BTR, BTRD, DLONG, DMP, ERTR, GCD,
    9         1 GCDKM, PMP, PWR, RLAT, RLATD, RLONG, RLONGD, RSN, SIGTR, TLAT,
   10         2 TLATD,TLONG,TLONGD,BRTD,FLUX,SSN,D90R,D50R,D10R,D90S,D50S,D10S
   11          DIMENSION NANGX(8)
************
                     Number of difference sections found: 1
                     Number of difference records  found: 4
```

SELMOD.FOR

```
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]SELMOD.FOR;1
    7          COMMON /RON /CLAT (5), CLONG (5), GLAT (5), RD (5), FI (3, 5), YI
    8         1(3, 5), HI (3, 5), HPRIM (30, 3), HTRUE (30, 3), FVERT (30, 3), KM
    9         B ,KFX,AFAC(30,3),HNOR(3),FX(3,5)
   10          IF(KFX -1)  100,100,105
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]SELMOD.FOR;1
    7          COMMON /RON /CLAT(5), CLONG(5), GLAT(5), RD(5), FI(3,5), YI(3,5),
    8         1HI(3,5), HPRIM(30,5), HTRUE(30,5), FVERT(30,5),KM,KFX, AFAC(30,5),
    9         2HTR(50), FNSQ(50)
   10          IF(KFX -1)  100,100,105
************
                     Number of difference sections found: 1
                     Number of difference records  found: 3
```

SELRCR.FOR

```
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]SELRCR.FOR;1
     8          COMMON/DON/ALATD,AMIN,AMIND,BTR,BTRD,DLONG,DMP,ERTR,GCD,GCDKM
     9          COMMON / LOSX / ANDVX(45,3), ADVX(45,3), AOFX(45,3), ARFX(45,3),
    10         1 GRLOSX(45,3), TGAINX(45,3), TLSKM(45,3)
    11          COMMON/LPATH/ GCDLNG,TGML(45),RGML(45),DELOPT,GMIN,YMIN,LTGM,LRGM
    12          COMMON/RAYS/ANG(40),IFOB(40,30,3),NANG
    13          COMMON/REFLX/DELFX(45,3),HPFLX(45,3),HTFLX(45,3),GDFLX(45,3),FVFLX
    14         A (45,3),DSKPKM(3),DELSKP(3),HPSKP(3),HTSKP(3),DMAXKM(3),FVSKP(3)
    15         B ,ISKP(3),IMODE(45,3),AFFLX(45,3),DELPEN(3,3)
    16          LRGM =1
    17          DEND = AMIN1(GCDKM,4000.)
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]SELRCR.FOR;1
     8          COMMON /DON /ALATD, AMIN, AMIND, BTR, BTRD, DLONG, DMP, ERTR, GCD,
     9         1 GCDKM, PMP, PWR, RLAT, RLATD, RLONG, RLONGD, RSN, SIGTR, TLAT,
    10         2 TLATD,TLONG,TLONGD,BRTD,FLUX,SSN,D90R,D50R,D10R,D90S,D50S,D10S
    11          COMMON/LOSX/ANDVX(45,3),ADVX(45,3),AOFX(45,3),ARFX(45,3),GRLOSX(45
    12         A ,3),TGAINX(45,3),TLSKM(45,3),AANEW(45,3),TDFLX(45,3),FSFLX(45,3)
    13          COMMON/LPATH/ GCDLNG,TGML(45),RGML(45),DELOPT,GMIN,YMIN,LTGM,LRGM
    14          COMMON/RAYS/ANG(40),IFOB(40,30,5),NANG
    15          COMMON/REFLX/DELFX(45,3),HPFLX(45,3),HTFLX(45,3),GDFLX(45,3),FVFLX
    16         A (45,3),DSKPKM(3),DELSKP(3),HPSKP(3),HTSKP(3),DMAXKM(3),FVSKP(3)
    17         B ,ISKP(3),IMODE(45,3),AFFLX(45,3),DELPEN(3,5)
    18          LRGM =1
    19          IF(GDFLX(2,3).EQ.0.)RETURN
    20          DEND = AMIN1(GCDKM,4000.)
************
                    Number of difference sections found: 1
                    Number of difference records  found: 12
```

SELTMT.FOR

```
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]SELTMT.FOR;1
     6          COMMON/DON/ALATD,AMIN,AMIND,BTR,BTRD,DLONG,DMP,ERTR,GCD,GCDKM
     7          COMMON / LOSX / ANDVX(45,3), ADVX(45,3), AOFX(45,3), ARFX(45,3),
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]SELTMT.FOR;1
     6          COMMON /DON /ALATD, AMIN, AMIND, BTR, BTRD, DLONG, DMP, ERTR, GCD,
     7         1 GCDKM, PMP, PWR, RLAT, RLATD, RLONG, RLONGD, RSN, SIGTR, TLAT,
     8         2 TLATD,TLONG,TLONGD,BRTD,FLUX,SSN,D90R,D50R,D10R,D90S,D50S,D10S
     9          COMMON / LOSX / ANDVX(45,3), ADVX(45,3), AOFX(45,3), ARFX(45,3),
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]SELTMT.FOR;1
    10          COMMON/RAYS/ANG(40),IFOB(40,30,3),NANG
    11          COMMON/REFLX/DELFX(45,3),HPFLX(45,3),HTFLX(45,3),GDFLX(45,3),FVFLX
    12         A (45,3),DSKPKM(3),DELSKP(3),HPSKP(3),HTSKP(3),DMAXKM(3),FVSKP(3)
    13         B ,ISKP(3),IMODE(45,3),AFFLX(45,3),DELPEN(3,3)
    14          DEND = AMIN1(GCDKM,4000.)
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]SELTMT.FOR;1
    12          COMMON/RAYS/ANG(40),IFOB(40,30,5),NANG
    13          COMMON/REFLX/DELFX(45,3),HPFLX(45,3),HTFLX(45,3),GDFLX(45,3),FVFLX
    14         A (45,3),DSKPKM(3),DELSKP(3),HPSKP(3),HTSKP(3),DMAXKM(3),FVSKP(3)
    15         B ,ISKP(3),IMODE(45,3),AFFLX(45,3),DELPEN(3,5)
    16          DEND = AMIN1(GCDKM,4000.)
************
************
```

SELTMT.FOR (cont'd.)

```
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]SELTMT.FOR;1
   17          GO TO 105
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]SELTMT.FOR;1
   19          IF(GDFLX(2,1).EQ.0.)RETURN
   20          GO TO 105
************
                    Number of difference sections found: 3
                    Number of difference records  found: 8
```

SERPRB.FOR

```
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]SERPRB.FOR;1
   12          COMMON/ANOIS/ATNU,ATNY,CC,TM,XEFF,RCNSE,DU,DL,SIGM,SIGU,SIGL,KJ,JK
   13          COMMON/CON/D2R,DCL,GAMA,PI,PI02,R2D,RZ,VOFL
   14          COMMON/DON/ALATD,AMIN,AMIND,BTR,BTRD,DLONG,DMP,ERTR,GCD,GCDKM,PMP
   15         A ,PWR,RLAT,RLATD,RLONG,RLONGD,RSN,SIGTR,TLAT,TLATD,TLONG,TLONGD
   16         B ,BRTD,FLUX,SSN,ATMNO,D90R,D50R,D10R,D90S,D50S,D10S
   17          COMMON/FRQ/FREL(29),FREQ
   18          COMMON / ION / IANT(3,2), NTR(2), IEA, IFQB, IFQE, IGRAPH,IHRE,
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]SERPRB.FOR;1
   12          COMMON/ANOIS/ATNU,ATNY,CC,TM,RCNSE,DU,DL,SIGM,SIGU,SIGL,KJ,JK
   13          COMMON/CON/D2R,DCL,GAMA,PI,PI02,R2D,RZ,VOFL
   14          COMMON /DON /ALATD, AMIN, AMIND, BTR, BTRD, DLONG, DMP, ERTR, GCD,
   15         1 GCDKM, PMP, PWR, RLAT, RLATD, RLONG, RLONGD, RSN, SIGTR, TLAT,
   16         2 TLATD,TLONG,TLONGD,BRTD,FLUX,SSN,D90R,D50R,D10R,D90S,D50S,D10S
   17          COMMON / FRQ / FREL(29), FREQ, JMODE
   18          COMMON / ION / IANT(3,2), NTR(2), IEA, IFQB, IFQE, IGRAPH,IHRE,
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]SERPRB.FOR;1
   21          COMMON/METSET/VERSN,ITRUN,ITOUT,JTRUN(40),JTOUT(40)
   22          COMMON / SON / ANGLE(13), ANGLER(13), CPROB(13), DBLOS(13),
   23         A DBLOSL(13), DBLOSU(13), DBU(13), DELAY(13), NDBW(13), NHP(13),
   24         B NYNOIS(13), PROBMP(13), RELIAB(13), SNDB(13), SNPR(13),
   25         C SNRLW(13), SNRUP(13), SPROB(13), VHIGH(13)
   26          COMMON/TON/ADJ,ADS,ATMO,GNOS,GOT,PWRDB,ZCNSE,REL,SL,SLS,SPR,SU,SUS
   27         A ,TIMER,XADJN,ZEFF,XNOISE,XTLOS,ZNOISE,NF
   28          COMMON/ZON/ABPS(7),CREL(7),EFF(7),FLDST(7),GRLOS(7),HN(7),HP(7)
   29         A ,PROB(7),RELY(7),RGAIN(7),SIGPN(7),SN(7),SPRO(7),TGAIN(7),TIMED
   30         B(7),TLOSS(7),B(7),FSLOS(7),ADV(7),OBF(7),NMODE(7),NPROB,NREL
   31         C , TLLOW(7),TLHGH(7)
   32          DIMENSION TME(10)
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]SERPRB.FOR;1
   21          COMMON / METSET / VERSN, ITRUN, ITOUT, JTRUN(40), JTOUT(40), LSEAS
   22          COMMON / SON / ANGLE(13), ANGLER(13), CPROB(13), DBLOS(13),
   23         A DBLOSL(13), DBLOSU(13), DBU(13), DELAY(13), DBW(13), NHP(13),
   24         B NYNOIS(13), PROBMP(13), RELIAB(13), SNDB(13), SNPR(13),
   25         C SNRLW(13), SNRUP(13), SPROB(13), VHIGH(13)
   26          COMMON/TON/ADJ,ADS,GNOS,GOT,PWRDB,REL,SL,SLS,SPR,SU,SUS
   27         A ,XNOISE,ZNOISE,NF
   28          COMMON / allMODE /ABPS(20),CREL(20),FLDST(20),HN(20),HP(20),
   29         1PROB(20),RELY(20),RGAIN(20),SIGPOW(20),SN(20),
   30         2SPRO(20),TGAIN(20),TIMED(20),TLOSS(20),B(20),FSLOS(20),
   31         CNMODE(20),TLLOW(20),TLHGH(20),EFF(20),NREL,NMMOD
   32          DIMENSION TME(10)
```

```
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]SERPRB.FOR;1
   44          DO 145 IM = 1,6
   45          IF( HP(IM) - 70.)  100,100,105
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]SERPRB.FOR;1
   44          DO 145 IM = 1,NMMOD
   45          IF( HP(IM) - 70.)  100,100,105
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]SERPRB.FOR;1
   84          SPROB(IF) = AMAX1(SPRO(1),SPRO(2),SPRO(3),SPRO(4),SPRO(5),SPRO(6))
   85          RETURN
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]SERPRB.FOR;1
   84          AMXX=-1000.
   85          DO 150 I=1,NMMOD
   86          IF(SPRO(I).GT.AMXX)AMXX=SPRO(I)
   87    150   CONTINUE
   88          SPROB(IF)=AMXX
   89          RETURN
************
                    Number of difference sections found: 4
                    Number of difference records  found: 23
```



```
                    Number of difference sections found: 0
                    Number of difference records  found: 0
```



```
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]SETLNG.FOR;1
    5          COMMON /RAYS/ ANG(40), IFOB(40,30,3), NANG
    6          COMMON/ES/FS(3,5),HS(5)
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]SETLNG.FOR;1
    5          COMMON /RAYS/ ANG(40), IFOB(40,30,5), NANG
    6          COMMON/ES/FS(3,5),HS(5)
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]SETLNG.FOR;1
    9          COMMON/RON/CLAT(5),CLONG(5),GLAT(5),RD(5),FI(3,5),YI(3,5),HI(3,5)
   10         A ,HPRIM(30,3),HTRUE(30,3),FVERT(30,3),KM,KFX,AFAC(30,3),HNOR(3)
   11         B ,FX(3,5),HTR(50),FNSQ(50)
   12          IF(KFX -3) 105,100,100
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]SETLNG.FOR;1
    9          COMMON /RON /CLAT(5), CLONG(5), GLAT(5), RD(5), FI(3,5), YI(3,5),
   10         1HI(3,5), HPRIM(30,5), HTRUE(30,5), FVERT(30,5),KM,KFX, AFAC(30,5),
   11         2HTR(50), FNSQ(50)
   12          IF(KFX -3) 105,100,100
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]SETLNG.FOR;1
   18          DO 120IS =2,5
   19          CLAT(IS)  = CLAT(1)
******
```

SETLNG.FOR (cont'd.)

```
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]SETLNG.FOR;1
   18          DO 120 IS =2,5
   19          CLAT(IS)  = CLAT(1)
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]SETLNG.FOR;1
   44          HNOR(IS) = HNOR(1)
   45          FX(1,IS) = FX(1,1)
   46          FX(2,IS) = FX(2,1)
   47          FX(3,IS) = FX(3,1)
   48          DO 125 IL= 1,30
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]SETLNG.FOR;1
   44          DO 125 IL= 1,30
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]SETLNG.FOR;1
   82          HNOR(3)  =HNOR(2)
   83          FX(1,3)  = FX(1,2)
   84          FX(2,3) = FX(2,2)
   85          FX(3,3)    = FX(3,2)
   86          DO 150 IL = 1,30
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]SETLNG.FOR;1
   78          DO 150 IL = 1,30
************
                    Number of difference sections found: 5
                    Number of difference records  found: 13
```

SETLUF.FOR

```
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]SETLUF.FOR;1
    3   C.....COMPUTED RELIABILITIES. THESE VALUES ARE CHANGED IN SUBROUTINES
    4   C.....SHTLUF OR GETLUF IF THE LUF IS ACTUALLY COMPUTED
    5   C
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]SETLUF.FOR;1
    3   C.....COMPUTED RELIABILITIES. THESE VALUES ARE CHANGED IN SUBROUTINE
    4   C.....GETLUF IF THE LUF IS ACTUALLY COMPUTED
    5   C
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]SETLUF.FOR;1
   15         A DBLOSL(13), DBLOSU(13), DBU(13), DELAY(13), NDBW(13), NHP(13),
   16         B NYNOIS(13), PROBMP(13), RELIAB(13), SNDB(13), SNPR(13),
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]SETLUF.FOR;1
   15         A DBLOSL(13), DBLOSU(13), DBU(13), DELAY(13), DBW(13), NHP(13),
   16         B NYNOIS(13), PROBMP(13), RELIAB(13), SNDB(13), SNPR(13),
************
                    Number of difference sections found: 2
                    Number of difference records  found: 3
```

SETOUT.FOR

```
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]SETOUT.FOR;1
   12          COMMON / METSET / VERSN, ITRUN, ITOUT, JTRUN(40), JTOUT(40)
   13          COMMON / MUFS / EMUF(24), F1MUF(24), F2MUF(24), ESMUF(24),
```

SETOUT.FOR (cont'd.)

```
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]SETOUT.FOR;1
   12          COMMON / METSET / VERSN, ITRUN, ITOUT, JTRUN(40), JTOUT(40), LSEAS
   13          COMMON / MUFS / EMUF(24), F1MUF(24), F2MUF(24), ESMUF(24),
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]SETOUT.FOR;1
   17          COMMON / TIME / IT, GMT, UTIME(24), GMTR
   18    C.....SET MUFS TO -1
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]SETOUT.FOR;1
   17          COMMON / TIME / IT, GMT, UTIME(24), GMTR, XLMT(24), ITIM, JTX
   18    C.....SET MUFS TO -1
************
                    Number of difference sections found: 2
                    Number of difference records  found: 2
```

SETRCR.FOR

```
***********
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]SETRCR.FOR;1
    8           COMMON/DON/ALATD,AMIN,AMIND,BTR,BTRD,DLONG,DMP,ERTR,GCD,GCDKM,PMP
    9          A ,PWR,RLAT,RLATD,RLONG,RLONGD,RSN,SIGTR,TLAT,TLATD,TLONG,TLONGD
   10          B ,BRTD,FLUX,SSN,ATMNO
   11           COMMON/CON/D2R,DCL,GAMA,PI,PI2,PIO2,R2D,RZ,VOFL
   12           COMMON/ES/FS(3,5),HS(5)
   13           COMMON/FRQ/FREL(29),FREQ
   14           COMMON/GEOG/GYZ(5),RAT(5),GMDIP(5),CLCK(5),ABIY(5),ARTIC(5),SIGPAT
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]SETRCR.FOR;1
    8           COMMON /DON /ALATD, AMIN, AMIND, BTR, BTRD, DLONG, DMP, ERTR, GCD,
    9          1 GCDKM, PMP, PWR, RLAT, RLATD, RLONG, RLONGD, RSN, SIGTR, TLAT,
   10          2 TLATD,TLONG,TLONGD,BRTD,FLUX,SSN,D90R,D50R,D10R,D90S,D50S,D10S
   11           COMMON/CON/D2R,DCL,GAMA,PI,PI2,PIO2,R2D,RZ,VOFL
   12           COMMON/ES/FS(3,5),HS(5)
   13           COMMON / FRQ / FREL(29), FREQ, JMODE
   14           COMMON/GEOG/GYZ(5),RAT(5),GMDIP(5),CLCK(5),ABIY(5),ARTIC(5),SIGPAT
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]SETRCR.FOR;1
   24           COMMON/RAYS/ANG(40),IFOB(40,30,3),NANG
   25           COMMON/REFLX/DELFX(45,3),HPFLX(45,3),HTFLX(45,3),GDFLX(45,3),FVFLX
   26          A (45,3),DSKPKM(3),DELSKP(3),HPSKP(3),HTSKP(3),DMAXKM(3),FVSKP(3
   27          B ),ISKP(3),IMODE(45,3),AFFLX(45,3),DELPEN(3,3)
   28           COMMON/RON/CLAT(5),CLONG(5),GLAT(5),RD(5),FI(3,5),YI(3,5),HI(3,5)
   29          B ,HPRIM(30,3),HTRUE(30,3),FVERT(30,3),KM,KFX,AFAC(30,3),HNOR(3)
   30          C ,FX(3,5)
   31           COMMON/RTANT/XETA,XSIG,XEPS,XND,XNL,XNH,TEX(4),ITANT,IRANT,RETA,
   32          A RSIG, REPS, RND, RNL, RNH, REX(4), TEFF, REFF, KASANT
   33           COMMON/TIME/ IT,GMT,WTIME(24)
   34           COMMON/TON/ADJ,ADS,ATMO,GNOS,GOT,PWRDB,RCNSE,REL,SL,SLS,SPR,SU,SUS
   35          A ,TIMER,XADJN,XEFF,XNOISE,XTLOS,ZNOISE,NF
   36           COMMON/ZON/ABPS(7),CREL(7),EFF(7),FLDST(7),CRLOS(7),HN(7),HP(7)
   37          A,PROB(7),RELY(7),RGAIN(7),SIGPOW(7),SN(7),SPRO(7),TGAIN(7),TIMED
   38          B (7),TLOSS(7),B(7),FSLOS(7),ADV(7),OBF(7),NMODE(7),NPROB,NREL
   39          C ,TLLOW(7),TLHGH(7)
   40            DEND = AMIN1(4000.,GCDKM)
******
```

SETRCR.FOR (cont'd.)

```
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]SETRCR.FOR;1
   24          COMMON/RAYS/ANG(40),IFOB(40,30,5),NANG
   25          COMMON/REFLX/DELFX(45,3),HPFLX(45,3),HTFLX(45,3),GDFLX(45,3),FVFLX
   26         A (45,3),DSKPKM(3),DELSKP(3),HPSKP(3),HTSKP(3),DMAXKM(3),FVSKP(3
   27         B ),ISKP(3),IMODE(45,3),AFFLX(45,3),DELPEN(3,5)
   28          COMMON /RON /CLAT(5), CLONG(5), GLAT(5), RD(5), FI(3,5), YI(3,5),
   29         1HI(3,5), HPRIM(30,5), HTRUE(30,5), FVERT(30,5),KM,KFX, AFAC(30,5),
   30         2HTR(50), FNSQ(50)
   31          COMMON/RTANT/XETA,XSIG,XEPS,XND,XNL,XNH,TEX(4),ITANT,IRANT,RETA,
   32         A RSIG, REPS, RND, RNL, RNH, REX(4), TEFF, REFF, KASANT
   33          COMMON / TIME / IT, GMT, UTIME(24), GMTR, XLMT(24), ITIM, JTX
   34          COMMON/TON/ADJ,ADS,GNOS,GOT,PWRDB,REL,SL,SLS,SPR,SU,SUS
   35         A ,XNOISE,ZNOISE,NF
   36          COMMON / ZON / ABPS(7), CREL(7), EFF(7), FLDST(7), GRLOS(7),
   37         1 HN(7), HP(7), PROB(7), RELY(7), kGAIN(7), SIGPOW(7), SN(7),
   38         2 SPRO(7), TGAIN(7), TIMED(7), TLOSS(7), B(7), FSLOS(7), ADV(7),
   39         3 OBF(7),NMODE(7),TLLOW(7),TLHGH(7)
   40           DEND = AMIN1(4000.,GCDKM)
**************
                    Number of difference sections found: 2
                    Number of difference records  found: 22
```

SETTMT.FOR

```
**************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]SETTMT.FOR;1
    6          COMMON/DON/ALATD,AMIN,AMIND,BTR,BTRD,DLONG,DMP,ERTR,GCD,GCDKM,PMP
    7         A ,PWR,RLAT,RLATD,RLONG,RLONGD,RSN,SIGTR,TLAT,TLATD,TLONG,TLONGD
    8         B ,BRTD,FLUX,SSN,ATMNO
    9          COMMON/CON/D2R,DCL,GAMA,PI,PI2,PIO2,R2D,RZ,VOFL
   10          COMMON/ES/FS(3,5),HS(5)
   11          COMMON/FRQ/FREL(29),FREQ
   12          COMMON/GEOG/GYZ(5),RAT(5),GMDIP(5),CLCK(5),ABIY(5),ARTIC(5),SIGPAT
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]SETTMT.FOR;1
    6          COMMON /DON /ALATD, AMIN, AMIND, BTR, BTRD, DLONG, DMP, ERTR, GCD,
    7         1 GCDKM, PMP, PWR, RLAT, RLATD, RLONG, RLONGD, RSN, SIGTR, TLAT,
    8         2 TLATD,TLONG,TLONGD,BRTD,FLUX,SSN,D90R,D50R,D10R,D90S,D50S,D10S
    9          COMMON/CON/D2R,DCL,GAMA,PI,PI2,PIO2,R2D,RZ,VOFL
   10          COMMON/ES/FS(3,5),HS(5)
   11          COMMON / FRQ / FREL(29), FREQ, JMODE
   12          COMMON/GEOG/GYZ(5),RAT(5),GMDIP(5),CLCK(5),ABIY(5),ARTIC(5),SIGPAT
**************
**************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]SETTMT.FOR;1
   22          COMMON/RAYS/ANG(40),IFOB(40,30,3),NANG
   23          COMMON/REFLX/DELFX(45,3),HPFLX(45,3),HTFLX(45,3),GDFLX(45,3),FVFLX
   24         A (45,3),DSKPKM(3),DELSKP(3),HPSKP(3),HTSKP(3),DMAXKM(3),FVSKP(3
   25         B ),ISKP(3),IMODE(45,3),AFFLX(45,3),DELPEN(3,3)
   26          COMMON/RON/CLAT(5),CLONG(5),GLAT(5),RD(5),FI(3,5),YI(3,5),HI(3,5)
   27         B ,HPRIM(30,3),HTRUE(30,3),FVERT(30,3),KM,KFX,AFAC(30,3),HNOR(3)
   28         C ,FX(3,5)
   29          COMMON/RTANT/XETA,XSIG,XEPS,XND,XNL,XNH,TEX(4),ITANT,IRANT,RETA,
   30         1 RSIG, REPS, RND, RNL, RNH, REX(4), TEFF, REFF, KASANT
   31          COMMON/TIME/ IT,GMT,WTIME(24)
   32          COMMON/TON/ADJ,ADS,ATMO,GNOS,GOT,PWRDB,RCNSE,REL,SL,SLS,SPR,SU,SUS
   33         A ,TIMER,XADJN,XEFF,XNOISE,XTLOS,ZNOISE,NF
   34          COMMON/ZON/ABPS(7),CREL(7),EFF(7),FLDST(7),CRLOS(7),HN(7),HP(7)
   35         A,PROB(7),RELY(7),RGAIN(7),SIGPOW(7),SN(7),SPRO(7),TGAIN(7),TIMED
```

```
   36         B (7),TLOSS(7),B(7),FSLOS(7),ADV(7),OBF(7),NMODE(7),NPROB,NREL
   37         C ,TLLOW(7),TLHGH(7)
   38    C.....FOR MAX. NUMBER OF HOPS
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]SETTMT.FOR;1
   22          COMMON/RAYS/ANG(40),IFOB(40,30,5),NANG
   23          COMMON/REFLX/DELFX(45,3),HPFLX(45,3),HTFLX(45,3),GDFLX(45,3),FVFLX
   24         A (45,3),DSKPKM(3),DELSKP(3),HPSKP(3),HTSKP(3),DMAXKM(3),FVSKP(3
   25         B ),ISKP(3),IMODE(45,3),AFFLX(45,3),DELPEN(3,5)
   26          COMMON /RON /CLAT(5), CLONG(5), GLAT(5), RD(5), FI(3,5), YI(3,5),
   27         1HI(3,5), HPRIM(30,5), HTRUE(30,5), FVERT(30,5),KM,KFX, AFAC(30,5),
   28         2HTR(50), FNSQ(50)
   29          COMMON/RTANT/XETA,XSIG,XEPS,XND,XNL,XNH,TEX(4),ITANT,IRANT,RETA,
   30         1 RSIG, REPS, RND, RNL, RNH, REX(4), TEFF, REFF, KASANT
   31          COMMON / TIME / IT, GMT, UTIME(24), GMTR, XLMT(24), ITIM, JTX
   32          COMMON/TON/ADJ,ADS,GNOS,GOT,PWRDB,REL,SL,SLS,SPR,SU,SUS
   33         A ,XNOISE,ZNOISE,NF
   34          COMMON / ZON / ABPS(7), CREL(7), EFF(7), FLDST(7), GRLOS(7),
   35         1 HN(7), HP(7), PROB(7), RELY(7), RGAIN(7), SIGPOW(7), SN(7),
   36         2 SPRO(7), TGAIN(7), TIMED(7), TLOSS(7), B(7), FSLOS(7), ADV(7),
   37         3 OBF(7),NMODE(7),TLLOW(7),TLHGH(7)
   38    C.....FOR MAX. NUMBER OF HOPS
************
                    Number of difference sections found: 2
                    Number of difference records  found: 22
```



```
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]SIGDIS.FOR;1
   14          COMMON/RON/CLAT(5),CLONG(5),GLAT(5),RD(5),FI(3,5),YI(3,5),HI(3,5)
   15         A ,HPRIM(30,3),HTRUE(30,3),FVERT(30,3),KM,KFX,AFAC(30,3),HNOR(3)
   16         B ,FX(3,5),HTR(50),FNSQ(50)
   17          COMMON/SIGD/DSL,ASM,DSU,AGLAT,DSLF,ASMF,DSUF,ACAV,FEAV,AFE,BFE,HNU
   18         A ,HTLOSS,XNUZ,XVE
   19          COMMON/TIME/IT,GMT,UTIME(24),GMTR,XLMT(24)
   20          COMMON/TON/ADJ,ADS,ATMO,GNOS,GOT,PWRDB,RCNSE,REL,SL,SLS,SPR,SU,SUS
   21         A ,TIMER,XADJN,XEFF,XNOISE,XTLOS,ZNOISE,NF
   22          GLAV = 0.0
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]SIGDIS.FOR;1
   14          COMMON /RON /CLAT(5), CLONG(5), GLAT(5), RD(5), FI(3,5), YI(3,5),
   15         1HI(3,5), HPRIM(30,5), HTRUE(30,5), FVERT(30,5),KM,KFX, AFAC(30,5),
   16         2HTR(50), FNSQ(50)
   17          COMMON/SIGD/DSL,ASM,DSU,AGLAT,DSLF,ASMF,DSUF,ACAV,FEAV,AFE,BFE,HNU
   18         A ,HTLOSS,XNUZ,XVE
   19          COMMON / TIME / IT, GMT, UTIME(24), GMTR, XLMT(24), ITIM, JTX
   20          COMMON/TON/ADJ,ADS,GNOS,GOT,PWRDB,REL,SL,SLS,SPR,SU,SUS
   21         A ,XNOISE,ZNOISE,NF
   22          COMMON /DON /ALATD, AMIN, AMIND, BTR, BTRD, DLONG, DMP, ERTR, GCD,
   23         1 GCDKM, PMP, PWR, RLAT, RLATD, RLONG, RLONGD, RSN, SIGTR, TLAT,
   24         2 TLATD,TLONG,TLONGD,BRTD,FLUX,SSN,D90R,D50R,D10R,D90S,D50S,D10S
   25          GLAV = 0.0
************
************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]SIGDIS.FOR;1
   39          CALL SYSSY(DUMMY1,DUMMY2,2,ADJ,SU,SL,FMP,SUP,SLP)
   40    C.....MEDIAN
```

SIGDIS.FOR (cont'd.)

```
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]SIGDIS.FOR;1
   42          IDP=2
   43          IF(GCDKM.GT.2500.)IDP=5
   44          CALL SYSSY(DUMMY1,DUMMY2,IDP,ADJ,SU,SL,FMP,SUP,SLP)
   45    C.....MEDIAN
**************
                    Number of difference sections found: 2
                    Number of difference records  found: 14
```

SYSSY.FOR

```
                    Number of difference sections found: 0
                    Number of difference records  found: 0
```

TABBOD.FOR

```
**************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]TABBOD.FOR;1
   13          COMMON / TIME / IT, GMT, UTIME(24), GMTR, XLMT(24)
   14          DIMENSION XFMT(13)
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]TABBOD.FOR;1
   13          COMMON / TIME / IT, GMT, UTIME(24), GMTR, XLMT(24), ITIM, JTX
   14          DIMENSION XFMT(13)
**************
                    Number of difference sections found: 1
                    Number of difference records  found: 1
```

TABS.FOR

```
**************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]TABS.FOR;1
    6          COMMON/FRQ/FREL(29),FREQ
    7          COMMON/CON/D2R,DCL,GAMA,PI,PI2,PIO2,R2D,RZ,VOFL
    8          COMMON/RON/CLAT(5),CLONG(5),GLAT(5),RD(5),FI(3,5),YI(3,5),HI(3,5)
    9          COMMON/GEOG/GYZ(5)
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]TABS.FOR;1
    6          COMMON / FRQ / FREL(29), FREQ, JMODE
    7          COMMON/CON/D2R,DCL,GAMA,PI,PI2,PIO2,R2D,RZ,VOFL
    8          COMMON /RON /CLAT(5), CLONG(5), GLAT(5), RD(5), FI(3,5), YI(3,5),
    9         1HI(3,5), HPRIM(30,5), HTRUE(30,5), FVERT(30,5),KM,KFX, AFAC(30,5),
   10         2HTR(50), FNSQ(50)
   11          COMMON/GEOG/GYZ(5)
**************
                    Number of difference sections found: 1
                    Number of difference records  found: 5
```

TIMVAR.FOR

```
**************
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]TIMVAR.FOR;1
    8          COMMON /TIME /IT, GMT, UTIME (24)
    9          COMMON /CON /AK, DCL, GAMA, PI, PI2, PIO2, BK, RZ, VOFL
   10          COMMON /RON /CLAT (5), CLONG (5), GLAT (5), RD (5), FI (3, 5), YI
   11         1(3, 5), HI (3, 5), HPRIM (30, 3), HTRUE (30, 3), FVERT (30, 3), KM
   12         2, KFX
   13          COMMON /GEOG /GYZ (5), RAT (5), GMDIP (5), CLCK (5), ABIY (5)
```

TIMVAR.FOR (cont'd.)

```
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]TIMVAR.FOR;1
     8          COMMON / TIME / IT, GMT, UTIME(24), GMTR, XLMT(24), ITIM, JTX
     9          COMMON /CON /AK, DCL, GAMA, PI, PI2, PIO2, BK, RZ, VOFL
    10          COMMON /RON /CLAT(5), CLONG(5), GLAT(5), RD(5), FI(3,5), YI(3,5),
    11         1HI(3,5), HPRIM(30,5), HTRUE(30,5), FVERT(30,5),KM,KFX, AFAC(30,5),
    12         2HTR(50), FNSQ(50)
    13          COMMON /GEOG /GYZ (5), RAT (5), GMDIP (5), CLCK (5), ABIY (5)
**********
                    Number of difference sections found: 1
                    Number of difference records  found: 5
```

VERSY.FOR

```
**********
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]VERSY.FOR;1
    13          COMMON /RON /CLAT (5), CLONG (5), GLAT (5), RD (5), FI (3, 5), YI
    14         1(3, 5), HI (3, 5), HPRIM (30, 3), HTRUE (30, 3), FVERT (30, 3), KM
    15         2, KFX
    16          COMMON /GEOG /GYZ (5), RAT (5), GMDIP (5), CLCK (5), ABIY (5)
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]VERSY.FOR;1
    13          COMMON /RON /CLAT(5), CLONG(5), GLAT(5), RD(5), FI(3,5), YI(3,5),
    14         1HI(3,5), HPRIM(30,5), HTRUE(30,5), FVERT(30,5),KM,KFX, AFAC(30,5),
    15         2HTR(50), FNSQ(50)
    16          COMMON /GEOG /GYZ (5), RAT (5), GMDIP (5), CLCK (5), ABIY (5)
**********
**********
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]VERSY.FOR;1
    19          COMMON / TIME / IT, GMT, UTIME(24), GMTR, XLMT(24)
    20          COMMON / TWO / F2D(16,6,6), P(29,16,8), ABP(2,8), DUD(5,12,5),
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]VERSY.FOR;1
    19          COMMON / TIME / IT, GMT, UTIME(24), GMTR, XLMT(24), ITIM, JTX
    20          COMMON / TWO / F2D(16,6,6), P(29,16,8), ABP(2,8), DUD(5,12,5),
**********
                    Number of difference sections found: 2
                    Number of difference records  found: 4
```

VIRTIM.FOR

```
**********
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]VIRTIM.FOR;1
     6          COMMON /TIME /IT, GMT, UTIME (24)
     7          COMMON / FILES / LUI, LUO, LU2, LU5, LU6, LU15, LU16, LU20, LU25,
     8         A LU26, LU35, LU61
     9          COMMON / METSET / VERSN, ITRUN, ITOUT, JTRUN(40), JTOUT(40)
    10    C.....THE TWO DIMENSIONAL ARRAYS ARE HERE USED AS A SINGLE DIMENSION
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]VIRTIM.FOR;1
     6          COMMON / TIME / IT, GMT, UTIME(24), GMTR, XLMT(24), ITIM, JTX
     7          COMMON / FILES / LUI, LUO, LU2, LU5, LU6, LU15, LU16, LU20, LU25,
     8         A LU26, LU35, LU61
     9          COMMON / METSET / VERSN, ITRUN, ITOUT, JTRUN(40), JTOUT(40), LSEAS
    10    C.....THE TWO DIMENSIONAL ARRAYS ARE HERE USED AS A SINGLE DIMENSION
**********
**********
```

VIRTIM.FOR (cont'd.)

```
File USD1:[VOALIB.IONCAP.SOURCE.ORIG]VIRTIM.FOR;1
   57     500 FORMAT('1',10X,'TIME VARIATION CANNOT BE DONE BECAUSE THE LONG',
   58        A' TERM COEFFICIENTS ARE NOT SET.',/,11X,'CHECK KRUN, IF CORRECT',
   59        B ' THEN THE MONTH - SUNSPOT CARD IS PROBABLY WRONG OR MISSING.')
******
File USD1:[DAEHLER.VOALIB.NEWCAP.SOURCE]VIRTIM.FOR;1
   57     500 FORMAT(1H1,10X,'TIME VARIATION CANNOT BE DONE BECAUSE THE LONG'
   58        A,' TERM COEFFICIENTS ARE NOT SET.',/,11X,'CHECK KRUN, IF CORRECT',
   59        B ' THEN THE MONTH - SUNSPOT CARD IS PROBABLY WRONG OR MISSING.')
************
                    Number of difference sections found: 2
                    Number of difference records  found: 6
```

XLIN.FOR

```
                    Number of difference sections found: 0
                    Number of difference records  found: 0
```

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